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TECHNICAL MEMORANDUM ADDITIONAL INVESTIGATION AT SITE 8 AND SITE 56 NSWC INDIAND HEAD MD

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CH2MHILL

Technical Memorandum

Additional Investigation Results for Sites 8 and 56

Naval Support Facility, Indian Head
Indian Head, Maryland

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Additional Investigation Results for Sites 8 and 56 at Naval Support Facility, Indian Head

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1.0 Introduction

This memorandum describes the results of the sediment and fish tissue sampling conducted downstream of Site 8 (Mercury Contamination at Building 766) and Site 56 (Lead Contamination at Industrial Wastewater Outfall 97) at the Naval Support Facility, Indian Head (NSF-IH), Indian Head, Maryland. The objectives and rationale for this investigation were outlined in the *Work Plan for Additional Investigation at Sites 8 and 56, NDWIH, Indian Head, Maryland* (herein referred to as Work Plan) (CH2M HILL, 2005).

2.0 Site Background

A synopsis of historical uses, previous environmental investigation results, and removal actions at Sites 8 and 56 is contained in the document entitled *Draft Desktop Evaluation for Site 8 – Mercury Contamination at Building 766, and Site 56 – Lead Contamination at Industrial Wastewater Outfall 87, Naval District Washington Indian Head* (CH2M HILL, 2004). To reduce duplication of information, a brief summary of site information, taken from the desktop evaluation document, is presented below.

Historical operations at Sites 8 and 56 released and deposited mercury and lead, respectively, into a stream and a pond located downstream of these sites (Figure 1). To address the mercury and lead contamination in sediments located downstream of both sites, sediment removal actions were performed at Site 8 in 1994 (Halliburton NUS, 1995) and at Site 56 in 1996 (OHM, 1997).

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3.0 Objectives

The Work Plan outlines the rationale for the additional investigation; hence, it will not be presented in this report. The objectives, as outlined in the Work Plan, are as follows:

- Characterize current lead and mercury concentrations in the middle and lower sections of the stream and the pond sediment. Compare these results to historical concentrations to assess whether these concentrations have changed.
- Characterize current lead and mercury concentrations in fish tissue from the pond. Compare these results to historical concentrations to determine if the concentrations have changed and to assess bioavailability of lead and mercury in fish.

4.0 Methodology

The additional sediment and fish sampling at Sites 8 and 56 was conducted by CH2M HILL from September 26 to 28, 2005. Field activities were conducted in accordance with the Work Plan. Any deviation from the Work Plan is noted below.

4.1 Stream Sediment Sampling

Eight sediment samples were collected from locations IS08SD01 through IS08SD08 along the stream that runs adjacent to Site 8 and Site 56 and terminates at the marsh/pond area (Figure 1). The actual locations were selected to target depositional areas within the channel. At the time of sampling, the water depth varied from 2 to 6 inches along the stream channel. The sediment samples were collected within the defined stream channel at a depth of 0 to 6 inches below the water-sediment interface using a sediment core device equipped with a liner tube. The lined core device was inserted directly into the stream sediment by hand, capping the top, and retrieving the core sample. This method of collection ensured that the fine material at the sediment-water interface, where the majority of biological exposure occurs, was collected. Most of the samples consisted of a layer of silt/floc material, approximately 2 inches thick, overlying a medium-grained sand. The thickness of the upper silt/floc layer was observed to generally decrease in an upstream direction.

After collection, the sediment samples were homogenized in a clean, stainless-steel bowl. The homogenized samples were then transferred into clean laboratory-supplied containers, which were then placed on ice for preservation. The samples were then shipped overnight under chain-of-custody to Katahdin Analytical Services (Katahdin) for analysis of lead mercury, and percent moisture. The analysis was conducted using U.S. Environmental Protection Agency (USEPA) CLP Inorganic SOW ILMO4 protocol.

4.2 Pond Sediment Sampling

Four sediment samples were collected from locations IS08PS01 through IS08PS04 of the pond (Figure 1). Before the installation of the weir in 1993, the pond was tidally influenced. Since then, the pond has been hydrologically cut off from tidal action in Mattawoman Creek. During the sampling event, the depth of water in the pond varied from 3 to 5 feet. The samples were collected from 0 to 6 inches below the water-sediment interface using a sediment core device equipped with a liner tube. The sediment samples consisted almost

entirely of silt interspersed with decayed vegetative material. The samples were homogenized in a clean, stainless-steel bowl after collection. The homogenized samples were then transferred into laboratory-supplied containers, which were then placed on ice for preservation. The samples were then shipped overnight under chain-of-custody to Katahdin for analysis of lead, mercury and percent moisture. The analyses were conducted using USEPA CLP Inorganic SOW ILMO4 protocol.

4.3 Fish Tissue Sampling

Fishes were collected from the pond using a dip net, baited minnow traps, and a monofilament gill net. The baited minnow traps were collocated with the pond sediment sample locations (Figure 1). The dip nets were also used in close proximity to the pond sediment sample locations. The monofilament gill net was used at the north and south ends of the pond. Baited trap nets were also used at one location near IS08PS02 and one location near IS08PS04. No fishes were caught using the trap nets. However, turtles (eastern painted turtle) were caught in abundance in the trap nets at both locations.

According to the Work Plan, eight whole-body fish samples were to be collected during the fish tissue sampling event; the samples were to consist of four composite eastern mosquitofish samples, two individual bluegill samples, and two brown bullhead samples. However, no brown bullheads were caught during the sampling event, and only one target-size bluegill was caught (and retained for analysis). Other species of fish were caught, however, and were collected in place of the targeted species that could not be collected. The fish species sampled during the field event are described below.

4.3.1 Eastern Mosquitofish

Four composite eastern mosquitofish samples, ISFSH01 through ISFSH04, were collected by dip netting in very close proximity to the four pond sediment sample locations (IS08PS01 through IS08PS04 on Figure 1). Each mosquitofish sample consisted of about 30 to 40 individual fish ranging in size from approximately 25 to 50 millimeters in length. The mosquitofish samples were placed in a Ziploc bag, which was then placed on ice inside a cooler to preserve the tissue samples. The samples were shipped overnight under chain-of-custody to Katahdin for processing (total sample homogenized, whole-body individuals) and analysis of lead, mercury and percent moisture. Analysis was conducted using USEPA CLP Inorganic SOW ILMO4 protocol.

120-160 fish

4.3.2 Bluegill

Only one target-size bluegill, IS08FSH05, was caught in the gill net set at the north end of the pond. The individual bluegill was 152 millimeters in length and was retained for analysis. Although not targeted, four composite samples of juvenile bluegill, IS08FSH09 through IS08FSH12, were collected to provide additional bioaccumulation data. The composite bluegill samples were collected in minnow traps that were collocated with the pond sediment sample locations (IS08PS01 through IS08PS04 on Figure 1). The composite bluegill samples ranged from 14 to 44 individual fish per sample, ranging in size from 25 to 76 millimeters. The individual and composite bluegill samples were placed in separate Ziploc bags and placed on ice inside a cooler preserve the tissue samples. The samples were then shipped under chain-of-custody to Katahadin for processing (total sample

over 90 fish

homogenized, whole-body individuals) and analysis of lead, mercury and percent moisture. Analysis was conducted using USEPA CLP Inorganic SOW ILMO4 protocol.

4.3.3 Gizzard Shad

Gizzard shad were not a target species in the Work Plan. However, they were found to be abundant in the pond and were collected for analysis. The adults of the species feed on plants, phytoplankton and algae, often retaining a large quantity of sediment in their stomachs (Scott and Crossman, 1998). Therefore, the species should provide a good surrogate for evaluating a longer-lived species that is highly exposed to sediments in the pond.

Multiple gizzard shad were caught in gill net sets at the north and south ends of the pond. Two individual gizzard shad samples, IS08FSH06 and IS08FSH07, were retained for analysis (302 and 176 millimeters in total length, respectively). The individual gizzard shad samples were placed in separate Ziploc bags and iced to preserve the tissue samples. The samples were then shipped under chain-of-custody to Katahadin for processing (total sample homogenized, whole-body) and analysis of lead, mercury and percent moisture. Analysis was conducted using USEPA CLP Inorganic SOW ILMO4 protocol.

5.0 Analytical Results

Historical and 2005 analytical results for mercury and lead at Sites 8 and 56 are presented below. The following subsections also identify the subset of historical analytical results that are used in a comparison with 2005 analytical data presented later in this memorandum.

5.1 Historical Data

Historical data presented in this memorandum were obtained from the following documents:

- Brown and Root Environmental, July 1995. *Summary Biomonitoring Report for Site 8 – Nitroglycerine Plant Office, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland.*
- Brown and Root Environmental, February 1996. *Summary Biomonitoring Report for IR Site 56 – IW87 Lead Contaminated Outfall, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland.*
- Halliburton NUS, January 1993. *Site Characterization Report for Site 8 – Nitroglycerin Plant Office at Indian Head Division Naval Surface Warfare Center* (herein referred to as the Site 8 Site Characterization Report).
- Halliburton NUS Corporation, July 1994. *Report on April 1994 Biomonitoring for Site 8– Nitroglycerin Plant Office, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland.*
- Tetra Tech NUS, July 1999. *Remedial Investigation Report for Sites 12, 39/41, 42, and 44, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland* (herein referred to as the Site 12 RI Report).

The historical data relevant to the discussion in this section are provided in Tables A-1 through A-6 in Attachment A. Figure A-1 in Attachment A depicts relevant historical and 2005 sample locations. The figure also shows the extents of the tidal pond before and after the weir was installed in 1993.

Note that only a portion of historical data collected from the sample locations shown in Figure A-1 was used in a comparison with the 2005 data. Subsequent sections of this memorandum outline the rationale for selecting the historical data subset from the broader range of sampling locations shown in Figure A-1. The additional sampling locations are included in this memorandum to provide the reader with a comprehensive understanding of historical conditions in the midsection and lower section of the stream as well as the pond.

5.1.1 Stream Sediment—Mercury

During the 1992 field activities documented in the Site Characterization Report at Site 8 (Halliburton NUS, 1993), 18 and 36 samples were collected from the midsection and lower section of the stream, respectively (Figure A-1). These quantities do not include field duplicate samples that were collected. Tables A-1 and A-2 summarize the analytical results from samples collected from the midsection and lower section of stream, respectively. As shown in these tables, samples consisted of soil and sediment samples collected from the stream channel and the channel overbanks. The samples were collected from various depth intervals.

During the 1992 Site Characterization Study at Site 8, 16 sediment samples were collected, downstream from the lower section of stream, from an area designated as a marsh/stream transition area. Results from these samples are presented in Table A-3, and the sampling locations are shown in Figure A-1. This area was subsequently submerged after a weir was installed downstream of the pond in April 1993.

Because the 2005 sediment samples were collected from the uppermost 6-inch depth, comparison to historical data considered only the samples collected from a similar depth. Thus, samples collected from other depth intervals (e.g., 6 to 12 inches) were excluded from the dataset used for comparison. Furthermore, historical samples collected from the channel overbanks were excluded from the dataset used for comparative purposes because the 2005 samples were not collected from these areas. Finally, sediment samples collected from the marsh/stream transition area were not included in the dataset because those locations were submerged and are no longer considered part of the stream. Taking these factors into consideration, the historical dataset used in the comparison with the 2005 data comprised of six samples from the midsection and four samples from the lower section of the stream. This data subset is summarized in Table A-7.

5.1.2 Stream Sediment—Lead

For lead, the historical dataset comprised sediment samples that were collected in May 1994 as part of a biomonitoring program for Site 8. One sediment sample was collected from the midsection of the stream and four samples were taken from the lower section of the stream, exclusive of field duplicate samples (Table A-4). Locations of these samples are shown in Figure A-1. The historical dataset used in the comparison with 2005 data is summarized in Table A-8.

5.1.3 Pond Sediment—Mercury and Lead

During the 1992 Site Characterization Study at Site 8, 57 sediment samples (excluding field duplicate samples) were collected along 6 transects within the pond. These samples were analyzed for mercury, and their concentrations are presented in Table A-5. Locations of these samples are shown in Figure A-1.

Three additional samples from the pond were collected in 1997 during a remedial investigation at Site 12 (Tetra Tech NUS, 1999). These samples were collected along the eastern shoreline of the pond during the RI. Locations of these samples are shown in Figure A-1. Table A-6 presents the lead and mercury results obtained from these sediment samples. As noted in the table, the samples were analyzed for additional analytical parameters that are summarized in the Site 12 RI Report (Tetra Tech NUS, 1999).

In accordance with the Work Plan, only the 1997 data (Table A-6) were used in the comparison with the 2005 analytical data. The 1997 data were used because they represented the most recent historical sediment data for the pond.

5.1.4 Fish Tissue—Mercury and Lead

From October 1992 until November 1995, whole-body fish samples and other aquatic organisms were collected from the pond and two control sites as part of a quarterly biomonitoring program. Samples collected between October 1992 and October 1994 were analyzed for mercury, and samples collected between April 1994 and November 1995 were analyzed for lead. During the biomonitoring program, the three fish species collected most frequently were brown bullhead (*Ameiurus nebulosus*), eastern mosquitofish (*Gambusia holbrooki*), and bluegill (*Lepomis macrochirus*). All fish of each species were combined and homogenized, with one analysis performed per composite species sample. Analytical results from the tissue analyses are presented in Table 1 (mercury) and Table 2 (lead).

5.2 2005 Data

5.2.1 Sediment

The results of the sediment chemical analyses are presented in Tables 3 and 4 for the stream and pond, respectively. Sample locations are shown on Figure 1. Mercury and lead were detected in each of the samples from both the stream and the pond.

Stream

The results presented in Table 3 show, in general, a decreasing trend in mercury and lead concentrations in a downstream to upstream direction. The highest mercury concentration of 64.4 L mg/kg was detected in the sample from location IS08SD07, which was collected approximately 150 feet upstream of the terminus of the stream, where the stream flows through a wetland area bordering the pond (Figure 1). The highest lead concentration of 249 L mg/kg was detected in the sample from location IS08SD05, which was collected in the stream channel immediately below the confluence of the stream and the drainage swale leading from Site 56 (Figure 1).

It should be noted that the concentrations of the detected metals are all L-qualified, which indicates that the result is biased low due to a low matrix spike recovery. Therefore, concentrations may be higher than the numeric result reported by the laboratory.

Pond

As shown in Table 4, mercury (55.5 L mg/kg) and lead (327 L mg/kg) concentrations in the pond were highest in the sediment sample collected from location IS08PS01, which is in the north end of the pond (Figure 1). Overall, the mercury concentrations ranged from 1.9 to 55.5 L mg/kg, whereas the lead concentrations ranged from 40.9 L to 327 L mg/kg.

5.2.2 Fish Tissue

Table 5 presents information on the fish samples collected and the analytical results for mercury, lead, and percent solids. Mercury was detected in all of the fish tissue samples at concentrations ranging from 0.023 K mg/kg (IS08FSH07) to 0.101 K mg/kg (IS08FSH02). The "K" qualifier was assigned during data validation to all fish tissue mercury concentrations, indicating that the analytical results may be biased high due to high matrix spike recovery. Except for sample IS08FSH04, which is U-qualified, all the other samples have lead concentrations ranging from 0.19 mg/kg (IS08FSH12) to 0.53 mg/kg (IS08FSH06). The maximum concentrations of lead and mercury detected in each fish species are included in Table 5.

6.0 Data Comparison and Evaluation

Following laboratory analyses, the data were validated by a third-party data validator. For each environmental medium sampled (stream sediment, pond sediment, and fish tissue), the validated data (herein referred to as "2005 data") were compared against previous sampling data (herein referred to as "historical data") to assess comparability of the datasets and to meet the objectives of this investigation.

6.1 Overview of Data Comparison Protocol

Below is a summary of the comparison protocol, which comprised an analytical variability evaluation or statistical comparison, or both, depending on the sample medium. A detailed discussion of these protocols is presented in the Work Plan.

6.1.1 Analytical Variability Evaluation

To determine if the 2005 data are comparable to historical data, an analytical variability evaluation was performed on the basis of the USEPA guidelines for data validation of inorganic environmental samples under the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) program (USEPA, 2004). Based on this guidance, an acceptable range of ±35 percent was selected for sediment samples. Figure 2 in the Work Plan presents a schematic of three possible outcomes stemming from a comparison of the 2005 dataset to the historical dataset based on the ±35 percent variability of the analytical results described above.

6.1.2 Statistical Comparison

Because a sufficient population of stream sediment samples was collected during this investigation, the 2005 and historical stream sediment data were statistically compared, in addition to the analytical variability evaluation described above. The objective of the statistical comparison was to determine whether a statistically significant increase in mercury or lead has occurred since the historical samples were collected. Because USEPA

suggests that the Wilcoxon Rank Sum test be used, rather than the Student's *t* Test, when the number of background or site samples is less than 20 (USEPA, 2002), the nonparametric Wilcoxon Rank Sum test was used for these comparisons.

6.1.3 Data Comparison Summary

The following summarizes the comparison procedures for each environmental medium; these procedures were followed for both mercury and lead concentrations.

- **Stream sediment samples**—Historical and 2005 data were compared using both the analytical variability evaluation on the mean concentrations and the statistical comparison procedures.
- **Pond sediment and fish tissue samples**—Historical and 2005 data were compared using the analytical variability evaluation on the maximum concentrations. Each species of fish was evaluated separately to determine whether any of the species have shown a probable increase in mercury or lead concentrations.

The results of the data comparison presented above were used to recommend the appropriate next steps at Sites 8 and 56. Figures 3 and 4 in the Work Plan illustrate the decision logic steps that were followed in performing this comparison to determine the appropriate site management decision for Site 8, Site 56, and the pond.

6.2 Stream Sediment

Tables 6 and 7 summarize the mercury and lead results, respectively, for the 2005 and historic sediment samples collected from the midsection and lower section of the stream. Both analytical variability and statistical analysis were performed on the stream sediment data.

6.2.1 Analytical Variability

Mercury

As shown in Table 6, the mean 2005 mercury concentration was 20.1 L mg/kg, which is more than 35 percent higher than the mean historical sediment mercury concentration of 0.99 mg/kg. The data used to calculate the historical mean concentration are summarized in Table A-7. This increase is not suggestive of analytical variability. However, it should be noted that the 2005 dataset is small and much of the historical sediment data were reported as non-detects at relatively high detection limits. Additionally, the "L" qualifier indicates that the current data is biased low, which means that the L-qualified concentrations could be higher than the concentrations reported by the laboratory. For the noted reasons, these data must be interpreted with caution.

Lead

As shown in Table 7, the mean 2005 lead concentration was 90.6 L mg/kg, which is more than 35 percent lower than the mean historical lead concentration of 432 L mg/kg. The data used to calculate the historical mean concentration are summarized in Table A-8. The results of this comparison suggest a noticeable decrease in lead concentration in the lower stream sediment, but less so in the midsection of the stream where concentrations do not appear to have changed substantially.

6.2.2 Statistical Comparison

The results of the statistical analysis are presented in Attachment B and summarized in Table 8. The statistical analysis was performed using a 0.05 level of significance. The probability of 5 percent or less is commonly used as the criterion for rejection of the null hypothesis. The Wilcoxon Rank Sum Test was used to compare the current data with the historical data.

Mercury

The probability value of 0.01 (Table 8) is less than the 0.05 significance level, which indicates that the null hypothesis can be rejected. This means that the 2005 concentrations are significantly higher than the historical concentrations. This conclusion appears to be driven by the 2005 samples IS08SD05 through IS08SD08, which were collected from the lower section of stream, downstream of the IW-87 Outfall area. The mercury concentrations in these samples ranged from 9.8 L mg/kg to 64.4 L mg/kg (Figure 1). In contrast, samples IS08SD01 through IS08SD04, which were collected upstream of the outfall, ranged in concentration from 0.82 L mg/kg to 2.9 L mg/kg.

Lead

The probability value of 0.92 (Table 8) is greater than the 0.05 significance level, which indicates that the null hypothesis cannot be rejected. This means that the 2005 concentrations are lower than the historical concentrations in the stream sediments.

6.3 Pond Sediment

Tables 6 and 7 summarize the mercury and lead results, respectively, for the 2005 and historic sediment samples collected from the pond.

6.3.1 Mercury

The maximum mercury concentration in pond sediment in the 2005 investigation was 55.5 L mg/kg. This concentration is more than 35 percent higher than the historic maximum mercury concentration of 0.1 mg/kg. It should be noted that the "L" qualifier indicates that the data is biased low. Concentrations could, therefore, be higher than the value reported by the laboratory. It should be noted that the 1997 samples were collected along the eastern edge of the pond (on the opposite end from Sites 8 and 56) as part of the Site 12 RI. These data were used for comparison purposes because they were the most recent data available for the pond. In addition, the 2005 sample IS08PS01 yielding the concentration of 55.5 L mg/kg was collected in an area that was formerly part of the stream before a weir was installed on the downstream end of the pond in 1993. Figure A-1 displays the 1993 and current footprints of the pond.

Although the data were not used in the analytical variability evaluation, sediment samples were collected from the pond and analyzed for mercury during the 1992 Site Characterization Study at Site 8. These data were not included because more recent samples were collected from the pond in 1997. Sample locations and analytical results from this investigation are shown in Figure A-1 and Table A-7, respectively, in Attachment A. Sediment concentrations in mercury showed somewhat comparable results between the 1992 and 2005 datasets. The two highest mercury concentrations measured in 1992 were collected from SS-113 (13.2 mg/kg) and SS-114 (13.8 mg/kg), the locations of which are shown in Attachment A, Figure A-1. The 2005 samples IS08PS03 and IS08PS02 were

collected in close proximity to SS-113 and SS-114, respectively. Mercury was detected at a concentration of 1.9 L mg/kg in IS08PS03 and at 2.2 L mg/kg in IS08PS02. This comparison suggests that mercury concentrations in sediment may actually have decreased in the pond between 1992 and 2005.

6.3.2 Lead

The maximum lead concentration found in the 2005 pond sediment samples was 327 L mg/kg, which is more than 35 percent higher than the historical maximum concentration of 52.2 mg/kg, obtained during the Site 12 RI. The four pond sediment samples collected during the 2005 investigation contained lead at concentrations ranging from 40.9 L to 327 L mg/kg. Again, it should be noted that the historical lead concentrations are based on samples collected in 1997 along the eastern edge of the pond.

6.4 Fish Tissue

6.4.1 Mercury

Table 9 presents the maximum mercury concentrations for the 2005 and historical mosquitofish and bluegill species. The gizzard shad was not analyzed for mercury before 2005. The October 1994 mosquitofish species exhibited the highest concentration of 0.27 mg/kg compared to the 2005 maximum concentration of 0.10 mg/kg. Comparison of the two maximum concentrations indicates a 63 percent decrease in the mosquitofish from 1994 to 2005. The July 1993 bluegill exhibited the highest concentration of 0.09 mg/kg compared to the 2005 maximum concentration 0.08 mg/kg. Comparison of the two maximum concentrations indicates an 11 percent decrease in the bluegill from 1993 to 2005. In general, the results suggest that the concentrations of mercury in fish within the pond have declined over time, even taking into consideration factors such as differences in the sizes of the fish samples and possible seasonal fluctuations.

6.4.2 Lead

Table 10 presents the maximum lead concentrations for the 2005 and historical mosquitofish, bluegill, and gizzard shad species. The October 2005 mosquitofish species exhibited the highest concentration of 0.48 mg/kg. Comparison of the 2005 result to the August 1995 maximum concentration of 0.3 mg/kg indicates a 60 percent increase in the mosquitofish.

The November 1995 bluegill exhibited the highest concentration of 0.4 mg/kg compared to the 2005 maximum concentration 0.37 mg/kg. Comparison of the two maximum concentrations indicates a decrease of about 8 percent in the bluegill from 1995 to 2005, although this decrease may be attributable to the lower number of significant digits that were used to report the 1995 fish tissue concentration.

The August 1995 gizzard shad species exhibited the highest concentration of 1.6 mg/kg compared to the 2005 maximum concentration of 0.53 mg/kg. Comparing the two maximum concentrations indicates a decrease of about 67 percent in the gizzard shad from 1995 to 2005.

6.5 Evaluation Outcomes

The following bullets summarize the outcomes of the evaluation described above.

6.5.1 Stream Sediment

Analytical Variability Comparison (Mean Concentrations)

- Mercury: The 2005 mean concentration (20.1 L mg/kg) is more than 35 percent higher than the historical mean concentration (0.99 mg/kg) measured during the 1992 Site Characterization Study.
- Lead: The 2005 mean concentration (90.6 L mg/kg) is more than 35 percent lower than the historical mean concentration (432 L mg/kg) measured in 1994 as part of previous biomonitoring activities.

Statistical Comparison (Wilcoxon Rank Sum Test)

- Mercury: The 2005 concentrations statistically exceeded historical concentrations.
- Lead: The 2005 concentrations did not statistically exceed historical concentrations.

6.5.2 Pond Sediment

Analytical Variability Comparison (Maximum Concentrations)

- Mercury: The 2005 maximum concentration (55.5 L mg/kg) is more than 35 percent higher than the historical maximum concentration (0.12 mg/kg) measured during the 1997 RI for Site 12.
- Lead: The 2005 maximum concentration (327 L mg/kg) is more than 35 percent higher than the historical maximum concentration (52.2 J mg/kg) measured during the 1997 RI for Site 12.

6.5.3 Fish Tissue

Nine of eleven tissue samples collected in 2005 were bluegill and mosquitofish, species that were also collected during historical biomonitoring activities. These samples were analyzed for mercury and lead. The other two samples were gizzard shad, which were only analyzed for lead and not for mercury during historical biomonitoring activities.

Analytical Variability Comparison (Maximum Concentrations)

- Mercury: For the mosquitofish, the 2005 maximum concentration (0.10 mg/kg) is more than 35 percent lower than the historical maximum concentration (0.27 mg/kg) measured during the October 1994 biomonitoring event. For the bluegill, the 2005 maximum concentration (0.08 mg/kg) is lower than but within 35 percent of the historical maximum concentration of 0.09 mg/kg measured during the July 1993 biomonitoring event.
- Lead: For the mosquitofish, the 2005 maximum concentration (0.48 mg/kg) is more than 35 percent higher than the historical maximum concentration (0.3 mg/kg) measured during the October 1994 biomonitoring event. For the bluegill, the 2005 maximum concentration (0.37 mg/kg) is lower than but within 35 percent of the historical maximum concentration of 0.4 mg/kg. The 2005 maximum concentration in gizzard shad (0.53 mg/kg) is more than 35 percent lower than the historical maximum concentration of 1.6 mg/kg measured during the August 1995 biomonitoring event.

6.6 Recommended Next Steps

The Work Plan presents a two-step decision logic process for determining the next step at Sites 8 and 56 based on the comparison of historical and 2005 data. The decision logic is summarized in Figure 4 of the Work Plan.

The first step in the decision logic involves comparing the historical and 2005 data for fish tissue and pond sediment. Possible outcomes of this comparison fall under one of the following four scenarios:

- Scenario A—Concentrations in fish tissue have increased, but concentrations in pond sediment have decreased from those in the historical dataset.
- Scenario B—Concentrations in both fish tissue and pond sediment in the 2005 dataset have increased from those in the historical dataset.
- Scenario C—Concentrations in fish tissue have decreased, but concentrations in pond sediment have increased from those in the historical dataset.
- Scenario D—Concentrations in both fish tissue and pond sediment have decreased from those in the historical dataset.

Based on the comparison outcomes above, Scenario B represents the outcome of the fish tissue and pond sediment data comparison.

As shown on Figure 4 in the Work Plan, the second step of the decision logic process is to compare the historical and 2005 datasets for stream sediment. The outcome of the analytical variability and statistical comparisons indicate that the 2005 mercury concentrations in stream sediment have increased compared to those in the historical dataset. The opposite is true for lead concentrations—both the analytical variability and statistical comparisons suggest that lead concentrations in the 2005 dataset have decreased compared to those in the historical dataset.

Based on these comparison outcomes and applying the decision logic outlined in the Figure 4 of the Work Plan, the appropriate next step for Site 8 and 56 was to perform an ecological risk evaluation. This evaluation is presented in the section below.

7.0 Ecological Risk Evaluation

The mercury concentrations in all of the sediment samples collected from the stream and the pond exceeded the USEPA Region III ecological screening value for mercury (0.18 mg/kg) (USEPA, 2005). Therefore, mercury in sediment poses a potential risk to ecological receptors in the stream and the pond. All of the sediment samples collected from the pond and four of the eight sediment samples from the stream have lead concentrations that exceed the USEPA Region III ecological screening value for lead (35.8 mg/kg). The four samples that exceeded the lead screening value were those collected from locations IS08SD05 through IS08SD08, downstream of the IW-87 Outfall (Figure 1). Thus, lead in the lower stream sediments and in the pond poses a potential risk to ecological receptors.

7.1 Risk to the Benthic Invertebrate Community

The USEPA Region III screening values are based on published consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald et al., 2000), which are guidelines for assessing the potential for adverse effects to sediment-dwelling organisms. Therefore, the potential risk identified is relevant for the benthic community in the stream and pond, and potentially for amphibians, but not directly relevant to many fishes and other wildlife. However, the potential risk to fishes and other higher-trophic-level receptors can be evaluated using the fish tissue data collected as part of the 2005 investigation.

The benthic macroinvertebrate community was monitored in the pond for 3 years from 1993 to 1995 as part of the Site 8 biomonitoring program. However, benthic macroinvertebrate samples were not collected in the stream during the biomonitoring study. The biomonitoring summary report (Brown and Root Environmental, 1995) concluded that the benthic macroinvertebrate community in the pond was depauperate, with low densities and taxa richness. These data, however, were generally consistent with the benthic invertebrate community found at the control site (Stump Neck Beaver Pond) and typical of the simple structure and low diversity of tidal freshwater marshes and ponds of the east coast. The benthic invertebrate community in the pond was dominated by oligochaetes and chironomids throughout the biomonitoring period, which was consistent with the Stump Neck Beaver Pond where these taxa were dominant. The biomonitoring report attributed the low densities and diversity of macroinvertebrates in the pond in 1993 to unusually heavy rains in the spring of 1993 and the draining of the pond to install the weir in April 1993. The report stated that it was unknown if the low densities found in 1994 and 1995 could have been related to slow recolonization of the benthic community following the disturbance in 1993 (significant flooding and the subsequent drainage of the pond to install the weir) or a long-term change in the benthic community structure caused by changes in the composition of the bottom substrate. In summary, the lead and mercury concentrations in the pond sediments exceeded ecological screening values and were determined to pose potential risk to the benthic community. The risk may not be significant because of the similarity in the benthic community structure between the site and the Stump Neck Beaver Pond; however, there is uncertainty given the age of the data and the timing of their collection relative to the installation of the weir.

7.2 Risk to the Fish Community

To characterize ecological risk to fishes in the pond, the maximum mercury and lead concentrations in fish tissue samples were compared to critical residue values from the literature (Table 11). The maximum mercury and lead concentrations in fish tissue were observed in the same mosquitofish sample, IS08FSH02. Table 12 presents the hazard quotient (HQ) calculated for each metal using the maximum concentration and critical residue value.

Because the maximum concentrations of mercury and lead are less than their respective critical residue values, the calculated HQ is less than 1 for each metal. Therefore, fish should not be at risk from these chemicals. This finding supports the conclusions of the biomonitoring studies, which indicated that (1) mercury and lead in the pond sediments may be in a form that is not readily bioavailable; (2) biota were not accumulating lead to a

significant degree; and (3) mercury levels in biota were low, indicating that mercury had stabilized.

There is, however, an uncertainty associated with the use of critical residue values, which were obtained from the literature for a different species, fathead minnow (*Pimephales promelas*). The extrapolation of toxicity data from fathead minnow to mosquitofish would result in an uncertainty. However, no tissue residue toxicity data were found for mosquitofish, bluegill, or gizzard shad.

The 2005 mercury and lead concentrations in mosquitofish sample IS08FSH02 and bluegill sample IS08FSH05 were compared to two fish species (pumpkinseed and spottail shiner) collected from a reference area, Area 6, as part of the Mattawoman Creek Study (Tetra Tech NUS, 2002) (Table 13). Although different fish species are represented, the 2005 data suggest that fishes in the pond are acquiring body burdens of mercury and lead at concentrations above background conditions in the creek. However, as discussed above, the tissue residue data suggest that mercury and lead are not bioaccumulating in fishes at concentrations that warrant further investigation.

7.3 Risk to Piscivorous Wildlife

The maximum whole-body fish tissue concentrations were used to estimate the risk to piscivorous wildlife that might forage at the site using an ingestion-based exposure model described in Attachment C. Three receptors were chosen as surrogate species to represent piscivorous wildlife that might feed on fish at the site; these include the mink, great blue heron, and osprey. The average mercury and lead concentrations in the gizzard shad samples were used to estimate risk to mink and osprey based upon the likely size of fish preyed on by these piscivorous wildlife species. The average mercury and lead concentrations in the smaller-sized fish species (mosquitofish and bluegill) were used to estimate risk to great blue heron based on this species' likely prey size. Calculated no adverse effect level (NOAEL) and low adverse effect level (LOAEL)-based HQs for the receptors are presented in Table 14. Only one NOAEL-based HQ for great blue heron exceeded 1. None of the LOAEL-based HQs exceeded 1. These results suggest that mercury and lead are not bioaccumulating in fish tissue at levels likely to pose an unacceptable risk to piscivorous wildlife.

8.0 Summary of Results

The results of the additional investigation at Sites 8 and 56 are summarized below.

- The 2005 mercury concentrations in the stream sediments appear to show a statistically significant increase relative to historical concentrations. The area with elevated mercury concentrations relative to historical levels is limited to the lower section of stream; however, the results for the midsection are ambiguous because much of the historical mercury concentrations were reported as non-detected at relatively high detection limits, which adds some uncertainty to this conclusion.
- The 2005 lead concentrations in the sediment samples from the stream, particularly those in the stream's lower section, show a decrease in concentration compared to the

historical samples. The 2005 lead concentrations in the pond, however, appear to have increased compared to the historical concentrations.

- Mercury concentrations in 2005 were higher in the pond sediment as compared to samples collected during the 1997 RI at Site 12. However, the historical samples were collected from the eastern edge of the pond, on the opposite side of the stream. The 2005 mercury concentrations are relatively consistent with mercury concentrations observed in pond sediment during the 1992 Site Characterization Study at Site 8.
- 2005 mercury concentrations in fish tissue did not exceed historical maximum concentrations, suggesting that the bioavailability of mercury in the pond system has not changed over time.
- Only one fish tissue sample, mosquitofish IS08FSH02, exhibited a 2005 lead concentration exceeding the historical level by more than the 35-percent analytical variability threshold. The maximum lead concentrations in the bluegill and gizzard shad were lower in 2005 than they were during historical biomonitoring events.
- Fish tissue mercury and lead concentrations are below critical residue values, suggesting that fish are not at risk from lead and mercury in the pond sediments.
- Mercury and lead are not bioaccumulating in fish tissue at levels likely to pose an unacceptable risk to piscivorous wildlife.
- Mercury and lead concentrations in the stream sediments and the upper portion of the pond (the area that was stream habitat prior to installation of the weir) may pose a risk to the benthic invertebrate community and/or amphibians.

9.0 Recommendations

Based on the findings of this additional investigation and ecological risk evaluation for Sites 8 and 56, the following recommendations are proposed:

- The elevated concentrations of mercury found in the lower section of stream and upper portion of the pond warrant further site-specific investigation to identify whether the concentrations represent a significant risk to the benthic community and/or amphibians.
- Site 56 should be closed pursuant to CERCLA and Maryland Department of the Environment regulations because this site is no longer contributing to lead concentrations in the stream and pond. Lead in the stream will be addressed through the ecological risk assessment for Site 8.
- The concentrations of lead and mercury in the pond, with the exception of the upper portion of the pond, do not warrant further evaluation based on the 2005 data and historical biomonitoring, which have shown that these metals are not bioaccumulating in organisms at significant levels to warrant concern.

10.0 References

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TABLE 1
Historical Mercury Concentrations in Fish Tissue
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Species	Oct 92	Jan 93	Apr 93	Jul 93	Oct 93	Apr 94	Oct 94
Brown bullhead*	0.04 (3)			0.05 (2)	0.05 (1)		***0.06 (2)***
Mosquitofish*	0.06 (16)	0.15 (4)			0.12 (36)		***0.27 (75)***
Bluegill*	0.02 (11)	0.02 (6)	0.06 (1)	***0.09 (2)***		0.07 (3)	0.07 (4)
Gizzard shad	—	—	—	—	—	—	—
Goldfish	—	—	—	—	—	—	—
Common carp	—	—	—	—	—	—	—
Creek chubsucker	—	0.03 (1)	—	—	—	—	—
Largemouth bass	—	—	—	—	—	—	—
Largemouth bass	—	—	—	—	—	—	—
White crappie	—	—	—	—	—	—	0.06 (2)
Black crappie	—	—	—	—	—	—	—
Pumpkinseed	—	—	—	—	—	0.09 (3)	—
Carp	—	—	—	—	—	0.03 (2)	—
Shiner	—	—	—	—	0.05 (4)	—	—
Mummichog	—	—	0.03 (8)	—	—	—	—
Warmouth	—	—	—	0.23 (1)	—	—	—
Crayfish	—	—	—	0.07 (2)	0.09 (4)	—	—

All units are in milligrams per kilogram.
Parentheses indicate the number of fish comprising the sample that was analyzed.
* Fish species targeted for sampling during the 2005 investigation. The maximum concentration for each species is shown in bold and italics.

Data are from *Summary Biomonitoring Report for Site 8—Nitroglycerin Plant Office* (Brown and Root Environmental, 1995).

TABLE 2
Historical Lead Concentrations in Fish Tissue, Sites 8 and 56
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Species	Apr 94	Oct 94	Aug 95	Nov 95
Brown bullhead[a]		0.5 (2)		***1.2 (4)***
Mosquitofish[a]		0.2 (75)	***0.3 (100+)***	
Bluegill[a]	<0.2[b] (3)	0.2 U (4)	0.2 (12)	***0.4 (12)***
Gizzard shad			1.6 (1)	0.7 (6)
Goldfish			0.3 (2)	0.4 (3)
Common carp	<0.2[b] (2)		0.4 (2)	<0.2[b] (1)
Creek chubsucker			0.4 (3)	0.4 (2)
Largemouth bass			0.7 (1)	0.2 U (2)
Largemouth bass			0.2 U (3)	
White crappie		0.2 U (2)	0.2 U (8)	<0.2[b] (2)
Black crappie			<0.2 (3)	<0.2[b] (6)
Pumpkinseed	0.2 U (3)			
Carp				
Shiner				
Mummichog				
Warmouth				
Crayfish				

All units are in milligrams per kilogram.
Parentheses indicate the number of fish composing the sample.
U—Nondetect, level shown is the detection limit.

[a]Fish species targeted for sampling during the 2005 investigation. The maximum concentration for each species is shown in bold and italics.
[b]Detected, but below measurable quantity.

Data are from: *Summary Biomonitoring Report for Lead at Site 8—Nitroglycerin Plant Office* (Brown and Root Environmental, 1995).

Summary Biomonitoring Report for IR Site 56—IW87, Lead Contaminated Outfall, Indian Head Division (Brown and Root Environmental, 1996).

TABLE 3
2005 Analytical Results for Stream Sediment Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Sample ID	Location	Lead (mg/kg)	Mercury (mg/kg)	Percent Solids
IS08SD01-0905	Midsection	9.0 L	2.6 L	64
IS08SD02-0905[1]	Midsection	10.5 L	0.82 L	62
IS08SD02P-0905 (duplicate)	Midsection	11.5 L	1.9 L	61
IS08SD03-0905	Midsection	7.1 L	2.9 L	66
IS08SD04-0905	Midsection	3.3 L	0.87 L	74
IS08SD05-0905	Lower Section	249 L	49.1 L	43
IS08SD06-0905	Lower Section	173 L	29.2 L	45
IS08SD07-0905	Lower Section	208 L	64.4 L	60
IS08SD08-0905	Lower Section	63.8 L	9.8 L	63
	Mean Concentration	90.6 L	20.1 L	
	Maximum Concentration	249 L	64.4 L	

[1] Analytical results from this sample were not used in the calculation of the mean concentration because these values are lower than the corresponding duplicate samples.

Concentrations are in dry weight.

Midsection of stream extends from downstream edge of 1994 removal action to Outfall IW-87.

Lower section of stream extends from Outfall IW-87 to the pond.

L – Positive result is biased low due to low matrix spike recovery.

IS08SD01-0905 indicates that the sample was collected from location IS08SD01 in September (09) 2005 (05). IS08 refers to Indian Head, Site 8; SD01 refers to a sediment sample from location 1.

TABLE 4
Analytical Results for Pond Sediment Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Sample ID	Location	Lead (mg/kg)	Mercury (mg/kg)	Percent Solids
IS08PS01-0905	Northern Portion of Pond	327 L	55.5 L	27
IS08PS02-0905	North-Central Portion of Pond	40.9 L	2.2 L	43
IS08PS03-0905	South Central Portion of Pond	68.6 L	1.9 L	34
IS08PS04-0905	Southern Portion of Pond	96.5 L	1.9 L	29
	Mean Concentration	133	15.4	
	Maximum Concentration	327 L	55.5 L	

Concentrations are in dry weight.

L – Positive result is biased low due to low matrix spike recovery.

IS08PS01-0905 indicates that the sample was collected from location IS08PS01 in September (09) 2005 (05). IS08 refers to Indian Head, Site 8; PS01 refers to a pond sediment sample from location 1.

TABLE 5
Analytical Results for Fish Tissue Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Sample ID	Species	Sample Type (No. of fish)	Size Range (mm)	Lead (mg/kg)	Mercury (mg/kg)	Percent Solids
IS08FSH01	Mosquitofish	Composite (30)	25 - 50	0.35	0.073 K	22
IS08FSH02	Mosquitofish	Composite (30)	25 - 50	0.48	0.101 K	23
IS08FSH03	Mosquitofish	Composite (30)	25 - 50	0.20 J	0.042 K	20
IS08FSH04	Mosquitofish	Composite (40)	25 - 50	0.15 U	0.048 K	22
IS08FSH05	Bluegill	Individual (1)	152	0.37	0.078 K	23
IS08FSH06	Gizzard shad	Individual (1)	302	0.53	0.050 K	31
IS08FSH07	Gizzard shad	Individual (1)	176	0.52	0.023 K	26
IS08FSH09	Bluegill	Composite (44)	38 - 76	0.23	0.062 K	23
IS08FSH10	Bluegill	Composite (16)	25 - 50	0.28 J	0.030 K	23
IS08FSH11	Bluegill	Composite (14)	35 - 65	0.29	0.033 K	22
IS08FSH12	Bluegill	Composite (22)	35 - 52	0.19	0.034 K	24
		Maximum Mosquitofish		0.48	0.101 K	
		Maximum Bluegill		0.37	0.078 K	
		Maximum Gizzard Shad		0.53	0.050 K	

Original results were reported by the lab as dry weight values and were converted to wet weight using the percent solids value.

K - Positive result is estimated and biased high due to high matrix spike recovery

J – Estimated value

U – Analyte was not detected above the reported method detection limit.

TABLE 6
Comparison of Historical and 2005 Mercury Concentrations in Stream and Pond Sediment Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Area Name	# Samples	Mean	Maximum	Range	Date Sampled	Name of Investigation
Stream	10[1]	0.99[2]	2.9 K	0.13 U – 2.9 K	May 1994	1992 Site Characterization Study
	8	20.1 L	64.4 L	0.9 L – 64.4 L	Oct. 2005	2005 Investigation
Pond	3	0.12	0.1	0.09 – 0.16	Oct. 1997	1999 Site 12 RI
	4	15.4	55.5 L	1.9 L – 55.5 L	Oct. 2005	2005 Investigation

All units are in milligrams per kilogram
[1] Soil samples collected from stream channel overbanks are not included in this number of samples

[2] One-half detection limit used for non-detected samples in calculating mean

K - Positive result is estimated and biased high due to high matrix spike recovery

L – Positive result is biased low due to low matrix spike recovery
U - Non-detected at reported detection limit

Historical stream sediment samples from the 0 to 6-inch depth interval are used for comparative purposes.

TABLE 7
Comparison of Historical and Current Lead Concentrations in Stream and Pond Sediment Samples
Additional Investigation Results for Sites 8 and 56
NSFIH, Indian Head, Maryland

Area Name	# Samples	Mean	Maximum	Range	Date Sampled	Name of Investigation
Stream	5	432	811	6.73 - 811	May 1994	April1994 Biomonitoring[2]
	8	90.6 L	249 L	3.3 L – 249 L	Oct. 2005	2005 Investigation
Pond	3	40	52.2 J	28.1 J – 52.2 J	Oct. 1997	1999 Site 12 RI Report
	4	133	327(L)	40.9 L – 327 L	Oct. 2005	2005 Investigation

[1] Only one sample was collected in 1994.

[2] The results from sediment samples collected in May 1994 were included in a report summarizing the April 1994 biomonitoring event (Haliburton NUS, 1994).

All units are in milligrams per kilogram.

J – Estimated value

L – Positive result is biased low due to low matrix spike recovery

Non-detected values were included in the mean as one half the non-detected (U-flagged) analytical results.

Historical stream sediment samples from the 0 to 6-inch depth interval are used for comparative purposes.

TABLE 8
Statistical Comparison of Historical and Current Lead and Mercury Concentrations in Stream Sediment
Additional Investigation Results for Sites 8 and 56
NSFIH, Indian Head, Maryland

Parameter	P-value	Are Historical Concentrations Exceeded (using 0.05 significance level)?	Current Mean / Median	Historical Mean / Median	Number of 2005 Samples	Number of Historical Samples
Mercury	0.0036	Yes	20.1 / 6.35	0.992 / 0.65	8	10
Lead	0.9249	No	90.6 / 37.7	432.7 / 491.0	8	5

TABLE 9
Comparison of Historical and 2005 Maximum Mercury Concentrations in Fish Tissue Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Species	Oct 92	Jan 93	Apr 93	Jul 93	Oct 93	Apr 94	Oct 94	Oct 05
Mosquitofish	0.06 (16)	0.15 (4)			0.12 (36)		***0.27*** (75)	0.10 (30)
Bluegill	0.02 (11)	0.02 (6)	0.06 (1)	***0.09*** (2)		0.07 (3)	0.07 (4)	0.08 (1)
Gizzard shad	—	—	—	—	—	—	—	0.05 (1)

All units are in milligrams per kilogram, wet weight.
Parentheses indicate the number of fish composing the composite sample that was analyzed .
The maximum concentration for each species is shown in bold font.

Historical data source: *Summary Biomonitoring Report for Site 8—Nitroglycerin Plant Office* (Brown and Root Environmental, 1995).

TABLE 10
Comparison of Historical and 2005 Maximum Lead Concentrations in Fish Tissue Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Species	Apr 94	Oct 94	Aug 95	Nov 95	Oct 05
Mosquitofish		0.2 (75)	0.3 (100+)		***0.48*** (30)
Bluegill	<0.2 (3)	0.2 U (4)	0.2 (12)	***0.4*** (12)	0.37 (1)
Gizzard shad			***1.6*** (1)	0.7 (6)	0.53 (1)

All units are in milligrams per kilogram, wet weight.
Parentheses indicate the number of fish composing the composite sample that was analyzed.
U—Nondetect, level shown is the detection limit.

The maximum concentration for each species is shown in bold font.
Historical data source: *Summary Biomonitoring Report for Lead at Site 8—Nitroglycerin Plant Office* (Brown and Root Environmental, 1996).

TABLE 11
Mercury and Lead Critical Residue Values
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

	Lead	Mercury
Tissue Benchmark (mg/kg, wet weight)	26.2	1.36
Benchmark Type	LOAEL	LOAEL
Fish Species	*Pimephales promelas*	*Pimephales promelas*
Effect	Behavior	Reduced Growth
Tissue	**Whole body**	**Whole body**
Exposure Route	Water	Water
Life-Stage	Juvenile	Adult
Reference	Environmental Residues Effects Database (ERED) http://el.erdc.usace.army.mil/ered/	Spry and Wiener, 1991
Comments	Significant reduction in feeding rate and ability to capture and eat prey (exposure duration not reported). NOAEL not reported for fathead minnow, but 2.55 mg/kg reported for brook trout (*Salvelinus fontinalis*) – no effect on growth	41-week exposure; aqueous mercuric chloride NOAEL not reported in Spry and Wiener, but NOEAL values ranging from 0.32 to 2.64 mg/kg (no effect on growth) reported in ERED for fathead minnow

TABLE 12
Calculated Hazard Quotients for Mercury and Lead
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Chemical	IS08FSH02 - Mosquitofish (mg/kg, wet wt.)	Critical Residue Value (mg/kg, wet wt.)	Hazard Quotient
Mercury	0.10	1.36	0.07
Lead	0.48	26.2	0.01

The maximum lead and mercury concentrations in fish tissue were both observed in Mosquitofish sample, IS08FSH02

TABLE 13
Comparison of Maximum Mercury and Lead Concentrations in Fish Tissue to Mattawoman Creek Reference Fish Tissue
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

	2005 Investigation Results		Reference Samples	
COC	IS08FSH02 Mosquitofish	IS08FSH05 Bluegill	Mattawoman Creek Pumpkinseed	Mattawoman Creek Spottail Shiner
Mercury	0.101	0.078	ND (0.05)	ND (0.05)
Lead	0.48	0.37	ND (0.24)	ND (0.24)

ND - not detected (detection limit in parentheses)
All values in milligrams per kilogram, wet weight

TABLE 14
Summary of Hazard Quotients for Piscivorous Wildlife
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

	Mink		Great Blue Heron		Osprey	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Mercury	0.03	0.02	**1.69**	0.56	0.01	<0.01
Lead	<0.01	<0.01	0.06	0.01	0.03	<0.01

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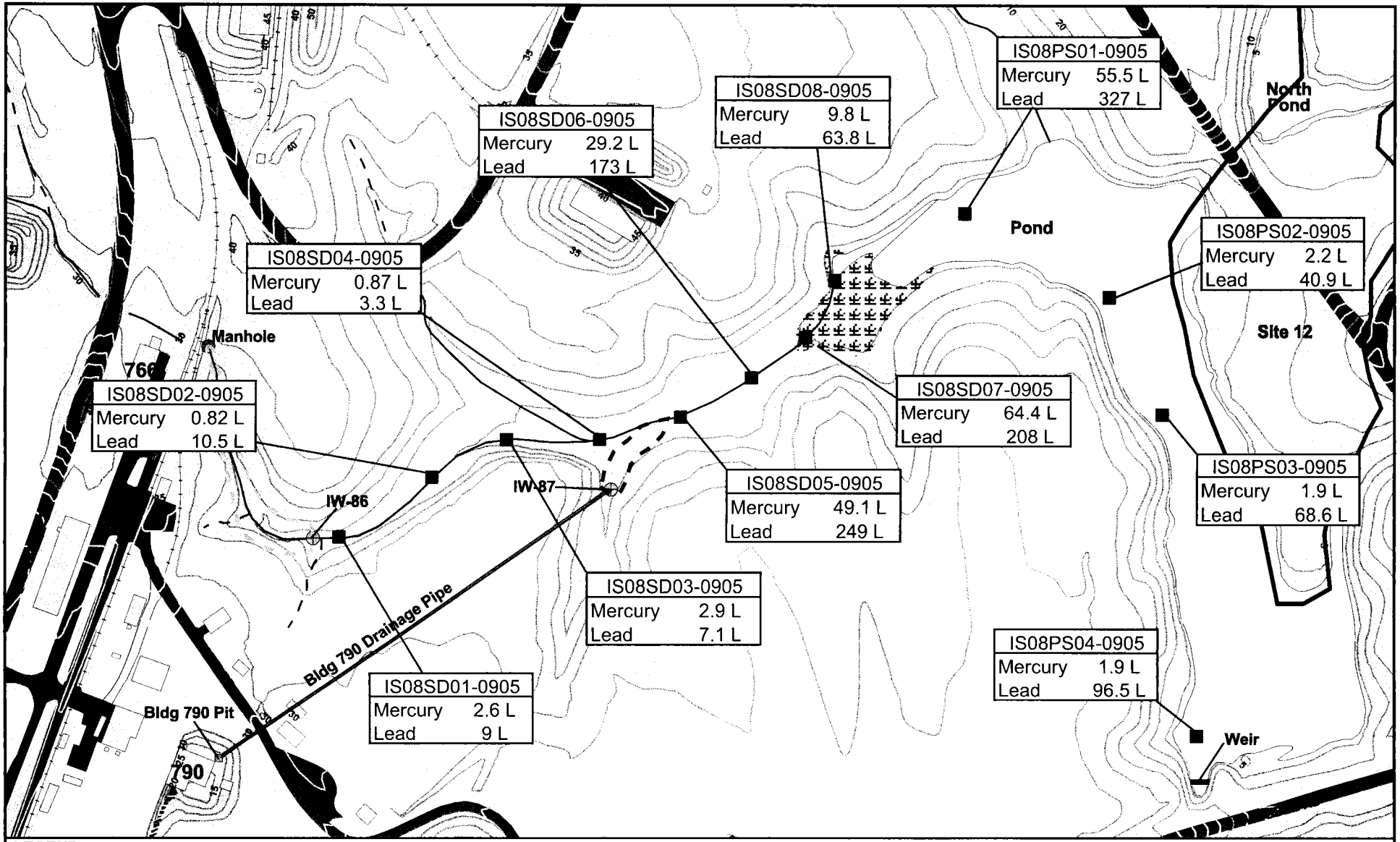

LEGEND

- Sediment Sample Location
- Approximate Extent 1994 Removal Action at Site 8
- Approximate Extent 1996 Removal Action at Site 56
- Building 790 Drainage Pipe
- Perennial Swale
- Intermittent Swale
- Elevation Contours (1ft Interval)
- Railroads
- Marsh
- Buildings
- Asphalt Road
- Dirt Road
- Gravel Road

100 0 100 200 Feet

N

All results in mg/kg (milligrams per kilogram)
ND - Non Detect
K(m) - Positive result is estimated and biased high due to high matrix spike recovery
J - Analyte was positively identified but the quantitation is an estimate

Figure 1
Analytical Results for 2005 Stream and Pond Sediment Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

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Attachment A

Historical Analytical Results for Stream and Pond Sediment

TABLE A-1
Sediment/Soil Analytical Results - Midsection of Stream - August 1992
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Sample Number	Location Description	Mercury (mg/kg)	
		0 to 6 inches	6 to 12 inches
SS-47	Stream Sediment	1.3 U	1.3 U
SS-48	Overbank	1.4 U	---
SS-49	Stream Sediment	1.3 U	1.4 U
SS-50	Overbank	15.5 U	---
SS-50-D	Overbank	14.8 U	---
SS-51	Stream Sediment	0.13 U	0.43 K(m)
SS-52	Overbank	1.3 U	---
SS-53	Stream Sediment	1.3 U	1.4 U
SS-54	Overbank	3.7 U	---
SS-55	Stream Sediment	1.4 U	0.48 K(m)
SS-56	Overbank	1.5 U	---
SS-57	Stream Sediment	1.2 U	0.26 K(m)
SS-57-D	Stream Sediment	1.3 U	---
SS-58	Overbank	1.3 U	---

Notes
--- No sample collected
SS-50-D and SS-57-D are field duplicate samples of SS-50 and SS-57, respectively.
U Analyte was not detected above the reported method detection limits
K(m) Positive results is estimated and biased high due to high matrix spike recovery
Source: Site Characterization Report for Site 8 - Nitroglycerin Plant Office (Halliburton NUS, 1993).

TABLE A-2
Sediment/Soil Analytical Results - Lower Section of Stream - August 1992
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample Number	Location Description	Mercury (mg/kg)	
		0 to 6 inches	6 to 12 inches
SS-34	North Overbank	1.1 J(m)	5.5 J(m)
SS-35	Mid - Overbank	29.6 UJ(m)	15.5 UJ(m)
SS-36	South Overbank	1.3 UJ(m)	3.3 UJ(m)
SS-37	Stream Sediments	1.5 K(m)	4.6 J(m)
SS-37-D	Overbank	2.9 K(m)	—
SS-38	Overbank	1.3 U	—
SS-39	Former Stream Channel	7.4 K(m)	—
SS-40	Former Stream Channel	2.3 U	—
SS-41	Stream Sediments	1.2 K(m)	6.1 L(m)
SS-41-D	Stream Sediments	—	6.7 K(m)
SS-42	Overbank	2.0 U	---
SS-43	Stream Sediments	1.3 U	1.7 U
SS-44	Overbank	1.7 U	---
SS-45	Stream Sediments	1.4 K(m)	2.6 K(m)
SS-45-D	Stream Sediments	1.8 K(m)	—
SS-46	Overbank	2.8 K(m)	---

Notes
--- No sample collected
SS-37-D, SS-41-D, and SS-45-D are field duplicate samples of SS-37, SS-41, and SS-45, respectively.
K(m) Positive results is estimated and biased high due to high matrix spike recovery
J(m) Value is estimated due to matrix spike noncompliances. Bias cannot be determined.
UJ(m) Nondetect is estimated due to matrix spike noncompliance. Bias cannot be determined.
Source: Site Characterization Report for Site 8 - Nitroglycerin Plant Office (Halliburton NUS, 1993).

TABLE A-3
Sediment/Soil Analytical Results - Marsh/Stream Transition Area - August 1992
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample Number	Location Description	Mercury (mg/kg)		
		0 to 6 inches	6 to 12 inches	12 to 18 inches
SS-23	Transect 7 - North	0.42 UJ(m)	0.26 UJ(m)	---
SS-24	Transect 7 - Middle	1.4 J(m)	1.9 J(m)	0.80 J(m)
SS-25	Transect 7 - South	3.9 UJ(m)	2.1 UJ(m)	---
SS-26	Transect 8 - North	4.8 UJ(m)	4.3 UJ(m)	---
SS-27	Transect 8 - Middle	45.7 UJ(m)	---	---
SS-28	Transect 8 - South	53.2 UJ(m)	61.3 UJ(m)	---
SS-29	Transect 9 - North	0.32 UJ(m)	18.4 UJ(m)	---
SS-29-D	Transect 9 - North	0.42 UJ(m)	---	---
SS-30	Transect 9 - South	18.9 UJ(m)	14.4 UJ(m)	---

Notes
--- No sample collected
SS-29-D is a field duplicate sample of SS-29
U Analyte was not detected above the reported method detection limits
UJ(m) Nondetect is estimated due to matrix spike noncompliance. Bias cannot be determined.
J(m) Value is estimated due to matrix spike noncompliances. Bias cannot be determined.
Source: Site Characterization Report for Site 8 - Nitroglycerin Plant Office (Halliburton NUS, 1993).

TABLE A-4
Sediment Analytical Results - Pond, Midsection, and Lower Section of Stream - May 1994
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Sample Number	Location Description	Lead Results (mg/kg)	Area
SO-400-00/01	Transect No. 2, 15 feet from west bank	236	Pond
SO-401-00/01	Transect No. 2, 100 feet from east bank	163	Pond
SO-402-00/01	Transect No. 4, 25 feet from west bank (403 Dup)	246	Pond
SO-403-00/01	Transect No. 4, 25 feet from west bank (402 Dup)	220	Pond
SO-404-00/01	Transect No. 4, 20 feet from east bank	199	Pond
SO-405-00/01	Transect No. 6, 80 feet from west bank	704	Pond
SO-406-00/01	Transect No. 6, 30 feet from east bank	196	Pond
SO-407-00/01	Transect no. 8, center of stream in swamp	811	Lower Section of Stream
SO-408-00/01	50 Feet north of Transect 8	780	Lower Section of Stream
SO-409-00/01	50 Feet downgradient of SS-35	491	Lower Section of Stream
SO-410-00/01	Center of Stream (Duplicate of 411)	40.6	Lower Section of Stream
SO-411-00/01	Center of stream (Duplicate of 410)	73	Lower Section of Stream
SO-412-00/01	Immediately downstream of discharge (IW-87)	79.2	Lower Section of Stream
SO-413-00/01	Upgradient of discharge (IW-87)	6.73	Midsection of Stream

Notes
Source: April 1994 Biomonitoring Report for Site 8 - Nitroglycerin Plant Office (Halliburton NUS, 1994)

TABLE A-5
Sediment/Soil Analytical Results - Pond - August 1992
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample Number	Location Description	Mercury (mg/kg)			
		0 to 6 inches	6 to 12 inches	12 to 18 inches	18 to 24 inches
SS-05	Transect 1 - East	2.5 J(d)	0.80 J(d)	---	---
SS-06	Transect 1 - Middle	2.3 J(d)	0.48 J(d)	---	---
SS-07	Transect 1 - West	0.95 J(d)	0.27 J(d)	---	---
SS-110	Between Transects 1 and 2 - West	0.81	0.29	---	---
SS-08	Transect 2 - East	0.29 J(d)	0.18 UJ(d)	0.23 UJ (d)	---
SS-09	Transect 2 - Middle	2.5 J(d)	0.49 J(d)	---	---
SS-09-D	Transect 2 - Middle	2.8 J(d)	---	---	---
SS-10	Transect 2 - West	5.1 J(d)	3.9 J(d)	6.0 J(d)	---
SS-10A	Transect 2 - West	---	0.92	0.26 U	---
SS-111	Between Transects 2 and 3 - West	6.1	0.27 U	---	---
SS-11	Transect 3 - East	7.9 J(d)	6.0 J(d)	---	---
SS-11A	Transect 3 - East	---	0.38	0.21 U	0.16 U
SS-12	Transect 3 - Middle	4.2 J(d)	0.43 J(d)	0.17 UJ(d)	---
SS-13	Transect 3 - West	7.0 J(d)	1.0 J(d)(1)	---	---
SS-13-D	Transect 3 - West	---	0.26 J(d)(1)	---	---
SS-112	Between Transects 3 and 4 West	7.4	0.19 U	0.24 U	---
SS-14	Transect 4 - East	5.4	0.5	---	---
SS-15	Transect 4 - Middle	8.3	0.19 U	---	---
SS-15-D	Transect 4 - Middle	8.2	6.1	---	---
SS-16	Transect 4 - West	9.2	---	---	---
SS-113	Between Transects 4 and 5 - West	13.2	13.4	---	---
SS-17	Transect 5 - East	6.6	1.1	0.17 U	---
SS-18	Transect 5 - Middle	0.44(2)	---	0.69(3)	---
SS-18-D	Transect 5 - Middle	0.48(2)	---	---	---
SS-19	Transect 5 - West	8.1(4)	0.33 U(5)	---	---
SS-114	Between Transects 5 and 6 - West	11.4	0.18 U	---	---
SS-114-D	Between Transects 5 and 6 - West	13.8	---	---	---
SS-20	Transect 6 -East	0.47 U	1.4 U	---	---
SS-21	Transect 6 - Middle	0.56 U	4.6(6)	0.27 U(7)	---
SS-22	Transect 6 - West	2.8 U	1.4	0.28	---

Notes
(1) Sample taken from a depth of 6 to 16 inches
(2) Sample taken from a depth of 0 to 10 inches
(3) Sample taken from a depth of 10 to 18 inches
(4) Sample taken from a depth of 0 to 4 inches
(5) Sample taken from a depth of 4 to 12 inches
(6) Sample taken from a depth of 8 to 14 inches
(7) Sample taken from a depth of 14 to 20 inches
--- No sample collected
"D" in the sample number designates this sample as a field duplicate.
U Analyte was not detected above the reported method detection limits
J(d) Value is estimated due to laboratory duplicate imprecision. Bias cannot be determined.
UJ(d) Nondetect is estimated due to laboratory duplicate imprecision. Bias cannot be determined.
Source: Site Characterization Report for Site 8 - Nitroglycerin Plant Office (Halliburton NUS, 1993)

TABLE A-6

Mercury and Lead Analytical Results - Pond - October 1997
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample Number:	**S12SD003**	**S12SD004**	**S12SD005**
Location:	**S12SD/SW03**	**S12SD/SW04**	**S12SD/SW04**
LEAD	28.1 J	52.2 J	
MERCURY	0.09	0.1	0.16

Notes
Results are presented in units of mg/kg.
Sediment samples were also analyzed for additional metals, volatile organic compounds, semivolatile organic compounds, pesticides, polychlorinated biphenyls, explosives, total organic carbon, and pH. These analytical results are presented in the Site 12 Remedial Investigation Report.

Source: 1999 Remedial Investigation Report for Site 12 (Tetra Tech NUS, 1999)

TABLE A-7

Historical Mercury Concentrations in Stream Used in Comparison with 2005 Concentrations
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample ID	Result (mg/kg)	1/2 Det Limit	Area
SS-47	1.3 U	0.65	Midsection of Stream
SS-49	1.3 U	0.65	Midsection of Stream
SS-51	0.13 U	0.07	Midsection of Stream
SS-53	1.3 U	0.65	Midsection of Stream
SS-55	1.4 U	0.70	Midsection of Stream
SS-57[1]			Midsection of Stream
SS-57D (dup)	1.3 U	0.65	Midsection of Stream
SS-37[1]			Lower Section of Stream
SS-37D (dup)	2.9 K		Lower Section of Stream
SS-41	1.2 K		Lower Section of Stream
SS-43	1.3 U	0.65	Lower Section of Stream
SS-45[1]			Lower Section of Stream
SS-45D (dup)	1.8 K		Lower Section of Stream
	Mean	**0.99**	
	Median	**0.65**	

Notes
Concentrations are shown as dry weight values.

[1] Analytical results from these samples were not used in the calculation of mean and median because their values are lower than their corresponding duplicate samples. Mercury concentrations in SS-57, SS-37, and SS-45 were 1.2, 1.5, and 1.4 mg/kg, respectively.

U Analyte was not detected above the reported method detection limit

K Positive result is estimated and biased high due to high matrix spike recovery

Source: Site Characterization Report for Site 8 - Nitroglycerin Plant Office
(Hallburton NUS, 1993)

TABLE A-8

Historical Lead Concentrations in Stream Used in Comparison with 2005 Concentrations
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample ID	Result (mg/kg)	Area
SO-407	811	Lower Section of Stream
SO-408	780	Lower Section of Stream
SO-409	491	Lower Section of Stream
SO-410[1]		Lower Section of Stream
SO-411(dup of 410)	73.0	Lower Section of Stream
SO-413	6.73	Mid Section of Stream
Mean	**432**	
Median	**491**	

Notes
Concentrations are shown as dry weight values.

[1] Analytical results for this sample was not used in the calculation of mean and median because this value is lower than its corresponding duplicate sample.

Source: April 1994 Biomonitoring Report for Site 8 - Nitroglycerin Plant Office (Hallburton NUS, 1993)

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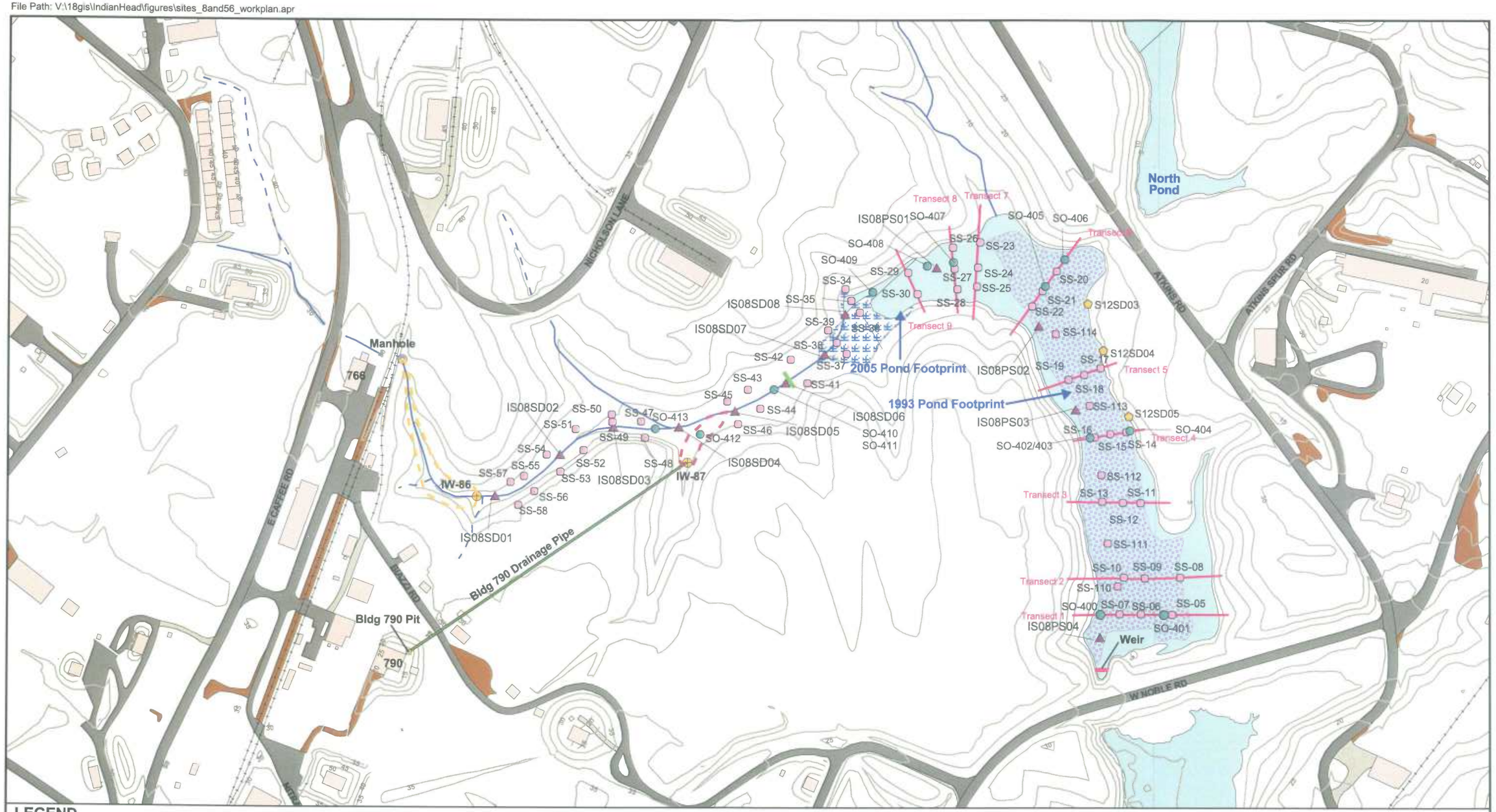

LEGEND

- 2005 Sediment Sample Location
- 1997 Sediment Sample Location (Site 12 Remedial Investigation)
- 1994 Sediment Sample Location (Biomonitoring for Site 8)
- 1992 Sediment Sample Location (Site Characterization Study at Site 8)
- Approximate Extent of 1994 Removal Action at Site 8
- Approximate Extent 1996 Removal Action at Site 56
- Elevation Contours (5 ft Interval)
- Perennial Swale
- Intermittent Swale
- Extent of Historic Tidal Pond
- Marsh
- Buildings
- Asphalt Road
- Dirt Road
- Gravel Road

N

0 200 400 Feet

Figure A-1
Historical and 2005 Sediment Sample Locations
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

CH2MHILL

Attachment B

Statistical Comparison of Historic and 2005 Stream Sediment Data

Statistical Comparison of Historic and 2005 Stream Sediment Data

Introduction

Background comparisons were performed for stream sediment at Sites 8 and 56 at Naval Support Facility, Indian Head (NSF-IH), Indian Head, Maryland. Summaries of the 2005 and historical data are provided in Tables B-1, B-2, and B-3. Table B-1 presents the 2005 lead and mercury concentrations, and Tables B-2 and B-3 present the historical concentrations used for statistical comparison for mercury and lead, respectively. The results of the Wilcoxon Rank Sum (WRS) statistical comparison between current and historical concentrations are shown in Table B-4.

In this evaluation, non-detected values were provided a proxy of ½ the detection limit. When duplicates were available, detected values were chosen over non-detected values, and higher detections were chosen over lower detections.

Wilcoxon Rank Sum Comparisons

The WRS test is a nonparametric test used for determining whether a difference exists between two populations. The WRS test was used instead of a parametric test such as the Student's *t*-test because the assumption of normality of the data set was not justified in this case. The WRS test can be used to test whether measurements from one population (such as the site population) tend to be shifted higher than those from another population (such as the background population). Acknowledged as a nonparametric test, it is suggested by U.S. Environmental Protection Agency (USEPA) background guidance for cases when the sample size is less than 20 (USEPA, 2002). As a nonparametric test based on ranks of the data, it is less influenced by spurious results in either data set than parametric tests, such as a t-test performed on the concentrations, which makes a distributional assumption about the data.

This test calculates the probability that the observed differences between the two populations are due merely to random variability in the data, as opposed to being due to an actual elevated shift in one. If this probability is less than a chosen significance level, in this case 0.05, then the decision is made that a significant difference does exist between the two populations. A significance level of 0. 05 implies that one has 95 percent confidence ([1 - 0. 05] x 100 percent) that the two groups will be determined to be statistically equivalent when they actually are.

References

USEPA. *Guidance for Data Quality Assessment. Practical Methods for Data Analysis.* Office of Research and Development, Washington, D.C. 2000.

USEPA. *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites*, Office of Emergency and Remedial Response, 2002.

TABLE B-1
2005 Analytical Results for Stream Sediment Samples
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Sample ID	Location	Lead (mg/kg)	Mercury (mg/kg)	Percent Solids
IS08SD01-0905	Midsection	9.0 L	2.6 L	64
IS08SD02-0905[1]	Midsection	10.5 L	0.82 L	62
IS08SD02P-0905 (duplicate)	Midsection	11.5 L	1.9 L	61
IS08SD03-0905	Midsection	7.1 L	2.9 L	66
IS08SD04-0905	Midsection	3.3 L	0.87 L	74
IS08SD05-0905	Lower Section	249 L	49.1 L	43
IS08SD06-0905	Lower Section	173 L	29.2 L	45
IS08SD07-0905	Lower Section	208 L	64.4 L	60
IS08SD08-0905	Lower Section	63.8 L	9.8 L	63
	Mean Concentration	90.6 L	20.1 L	
	Maximum Concentration	249 L	64.4 L	

[1] Analytical results from this sample were not used in the calculation of the mean concentration because these values are lower than the corresponding duplicate samples.

Concentrations are in dry weight.

Midsection of stream extends from downstream edge of 1994 removal action to Outfall IW-87.

Lower section of stream extends from Outfall IW-87 to the pond.

L – Positive result is biased low due to low matrix spike recovery.

IS08SD01-0905 indicates that the sample was collected from location IS08SD01 in September (09) 2005 (05). IS08 refers to Indian Head, Site 8; SD01 refers to a sediment sample from location 1.

TABLE B-2
Historical Mercury Concentrations in Stream Used in Comparison with 2005 Concentrations
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample ID	Result (mg/kg)	1/2 Det Limit	Area
SS-47	1.3 U	0.65	Midsection of Stream
SS-49	1.3 U	0.65	Midsection of Stream
SS-51	0.13 U	0.07	Midsection of Stream
SS-53	1.3 U	0.65	Midsection of Stream
SS-55	1.4 U	0.70	Midsection of Stream
SS-57[1]			Midsection of Stream
SS-57D (dup)	1.3 U	0.65	Midsection of Stream
SS-37[1]			Lower Section of Stream
SS-37D (dup)	2.9 K		Lower Section of Stream
SS-41	1.2 K		Lower Section of Stream
SS-43	1.3 U	0.65	Lower Section of Stream
SS-45[1]			Lower Section of Stream
SS-45D (dup)	1.8 K		Lower Section of Stream
	Mean	**0.99**	
	Median	**0.65**	

Notes

Concentrations are shown as dry weight values.

[1] Analytical results from these samples were not used in the calculation of mean and median because their values are lower than their corresponding duplicate samples. Mercury concentrations in SS-57, SS-37, and SS-45 were 1.2, 1.5, and 1.4 mg/kg, respectively.

U Analyte was not detected above the reported method detection limit

K Positive result is estimated and biased high due to high matrix spike recovery

Source: Site Characterization Report for Site 8 - Nitroglycerin Plant Office (Halliburton NUS, 1993)

TABLE B-3
Historical Lead Concentrations in Stream Used in Comparison with 2005 Concentrations
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Sample ID	Result (mg/kg)	Area
SO-407	811	Lower Section of Stream
SO-408	780	Lower Section of Stream
SO-409	491	Lower Section of Stream
SO-410[1]		Lower Section of Stream
SO-411(dup of 410)	73.0	Lower Section of Stream
SO-413	6.73	Mid Section of Stream
Mean	**432**	
Median	**491**	

Notes

Concentrations are shown as dry weight values.

[1] Analytical results for this sample was not used in the calculation of mean and median because this value is lower than its corresponding duplicate sample.

Source: April 1994 Biomonitoring Report for Site 8 - Nitroglycerin Plant Office (Halliburton NUS, 1994)

TABLE B-4
Central Tendency Comparisons of Site (Indian Head Sites 8 and 56) and Historical Data
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head, Maryland

Parameter	Assumed Distribution for Comparison	Probability that the Observed Differences Would Occur Purely by Chance	Are Historical Concentrations Exceeded (using 0.05 significance level)?	Site Mean	Historical Mean	Site Median	Historical Median	Number of Site Samples	Number of Background Samples
Lead	Nonparametric	0.9249	no	90.6	432.7	37.7	491.0	8	5
Mercury	Nonparametric	0.0036	Yes	20.1	0.992	6.35	0.65	8	10

Attachment C

Food Web Exposure Model and Ingestion Screening Values

Food Web Exposure Model for Piscivorous Wildlife

Mink, great blue heron, and osprey exposures (via the food web) to lead and mercury were determined using measured fish tissue concentrations and food web models. Incidental ingestion of sediment was not included when calculating the total level of exposure because these receptors feed directly on fish and are unlikely to have a significant exposure to sediment via incidental ingestion.

Fish tissue concentrations were reported in wet weight and were converted to dry weight for the food web exposure model using the reported percent moisture values.

Dietary intakes for each receptor species were calculated using the following formula (modified from USEPA [1993]):

$$DI_x = \frac{[\sum_i (FIR)(FC_{xi})(PDF_i)]}{BW}$$

where: DI_x = Dietary intake for chemical x (mg chemical/kg body weight/day)

FIR = Food ingestion rate (kg/day, dry weight)

FC_{xi} = Concentration of chemical x in food item i (mg/kg, dry weight)

PDF_i = Proportion of diet composed of food item i (dry weight basis)

BW = Body weight (kg, wet weight)

The exposure assumptions used in the food web model were:

- All of the dietary items consumed by the receptor were assumed to be obtained from the site (i.e., an Area Use Factor of 1 was assumed).
- Chemicals in fish tissue were assumed to be 100 percent bioavailable.
- Average ingestion rates were used.
- Average body weights were used.

The exposure parameters used in the food web model are shown in Table A-1.

TABLE C-1
Exposure Parameters for the Piscivorous Wildlife
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

	Body Weight (kg)		Food Ingestion Rate (kg/day - dry)		Dietary Composition (percent)	
Receptor	**Value**	**Reference**	**Value**	**Reference**	**Fishes**	**Reference**
Mink	0.777	Silva and Downing, 1995	0.0266	USEPA, 1993	100%	Assumed 100% for this evaluation; USEPA 1993 reported 94% fish
Great blue heron	2.23	Quinney, 1982	0.3931	Allometric equation	100%	USEPA, 1993
Osprey	1.49	Dunning, 1993	0.0780	USEPA, 1993	100%	USEPA, 1993

Ingestion Screening Values

Ingestion screening values for dietary exposures of lead and mercury were derived for each receptor. Toxicological information from the literature for wildlife species most closely related to the receptor species was used, where available, but was also supplemented by laboratory studies of non-wildlife species (e.g., rats) where necessary. The ingestion screening values are expressed as milligrams of the chemical per kilogram body weight of the receptor per day (mg/kg-BW/day).

Sublethal endpoints were emphasized as assessment endpoints where available since they are the most relevant, ecologically, to maintaining viable populations and because they are generally the most studied chronic toxicological endpoints for ecological receptors. Sublethal endpoints are assumed to influence the probability of survival and/or the success of reproduction. If several chronic toxicity studies are available from the literature, the most appropriate study was selected for each receptor species based on study design, study methodology, study duration, study endpoint, and test species. Lowest Observed Adverse Effect Levels (LOAELs) based on survival, growth, or reproduction were utilized, where available, as the screening values. For lead and birds, a chronic Lowest Observed Adverse Effect Levels (LOAEL) was estimated from a NOAEL using an uncertainty factor of 5. Ingestion screening values for birds and mammals are shown in Table A-2.

TABLE C-2
Ingestion Screening Values for the Piscivorous Wildlife
Additional Investigation Results for Sites 8 and 56
NSF-IH, Indian Head Maryland

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Reference
Lead	rat	0.35	3 generations	oral in diet	reproduction	8.0	80.0	Sample et al. 1996
	American kestrel	0.13	7 months	oral in diet	reproduction	3.85	19.3	Sample et al. 1996
Mercury	mink	1.0	93 days	oral in diet	survival / weight loss	0.15	0.25	Sample et al. 1996
	mallard	1.0	3 generations	oral in diet	reproduction	0.026	0.078	USEPA, 1997 Value used for great blue heron
	red-tailed hawk	1.10	12 weeks	oral in diet	survival/ neurological	0.49	1.20	USEPA 1995 Value used for osprey

References

Dunning, J.B., Jr. (editor). 1993. *CRC handbook of avian body masses.* CRC Press, Boca Raton, FL. 371 pp.

Quinney, T.E. 1982. Growth, diet, and mortality of nestling great blue herons. *Wilson Bulletin.* 94:571-577.

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter II, and C.J.E. Welsh. 1997. *Methods and tools for estimation of the exposure of terrestrial wildlife to contaminants.* Environmental Sciences Division, Oak Ridge National Laboratory. ORNL/TM-13391.

Silva, M. and J.A. Downing. 1995. *CRC handbook of mammalian body masses.* CRC Press, Boca Raton, FL. 359 pp.

U.S. Environmental Protection Agency (USEPA). 1995. Great Lakes Water Quality Initiative criteria documents for the protection of wildlife: DDT, mercury, 2,3,7,8-TCDD, PCBs. EPA/820/B-95/008.

USEPA. 1997. Mercury Study Report to Congress EPA-452-R-97-003-009.

USEPA. 1993. Wildlife exposure factors handbook. Volume I of II. EPA/600/R-93/187a.

CONCURRENCE FOR NO FURTHER ACTION

SIGNATURE PAGE

Site 56 – Lead Contamination at Industrial Wastewater Outfall 87

Naval Support Facility, Indian Head

In 2005, the United States Navy (Navy), in partnership with the United States Environmental Protection Agency (USEPA) Region III and Maryland Department of the Environment (MDE), conducted an investigation at Sites 8 and 56 at the Naval Support Facility, Indian Head in Indian Head, MD. Constituent concentrations, pathways, and receptors were evaluated by comparing the findings of the 2005 investigation with those obtained from previous investigations performed between 1992 and 1997. The investigation findings revealed that Site 56 is no longer contributing to lead concentrations in sediment downstream from the site.

Based upon the information obtained during the 2005 investigation, it is the consensus of the Navy and USEPA, with concurrence from the MDE and other members of the Indian Head Installation Restoration Team (IHIRT), that Site 56 requires no further action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). In the event contamination posing an unacceptable risk to human health or the environment is discovered after execution of this agreement, the IHIRT agrees to reevaluate this site as deemed necessary.

9/27/06
Date

Dennis Orenshaw
Remedial Project Manager
EPA Region III

Shawn A Jorgensen 9/27/06
Date

Shawn Jorgensen
Remedial Project Manager
Naval Support Facility, Indian Head

9/27/06
Date

Jeff Morris
Remedial Project Manager
Naval Facilities Engineering Command

9/27/06
Date

Joe Rail
Remedial Project Manager
Naval Facilities Engineering Command

Morris, Jeffrey CIV (NAVFACWASH)

From: Morris, Jeffrey CIV (NAVFACWASH)
Sent: Monday, June 12, 2006 3:56 PM
To: DeTore Curtis (E-mail); Jorgensen, Shawn; Kasim Margaret (E-mail); Latulippe George (E-mail); Metcalf Christine. (E-mail); Morris, Jeffrey CIV (NAVFACWASH); Orenshaw Dennis (E-mail); Rail, Joseph CIV (NAVFACWASH)
Subject: Comments on Tech Memo for Sites 8 & 56

Here are our risk reviewer's comments:

Editorial
1. The text in section 5.1.1, first sentence states that "...36 samples were collected from the...lower section of the stream..."; however Table A-2 shows only 21 samples exclusive of the duplicate samples.

2. Table A-2: Sample SS-37 is listed as a "Stream Sediments" sample, while its duplicate SS-37 D is listed as an overbank sample. Correct whichever is in error.

3. Page C-1, last word: change "Table A-1" to "Table C-1".

4. Page C-2, last word: change "Table A-2" to "Table C-2".

Substantiative

5. Section 5.1.3: The comparison for the determination of trends in Hg and Pb concentrations in pond sediment should not be based on the 1997 sediment samples. These three samples are not representative of the conditions of the pond and also do not reflect the conditions present at the 2005 sediment sampling locations. In this case, it should be noted in the text that this comparison is inappropriate and instead, the 2005 data can be compared to nearby 1992 data locations for mercury concentrations, and to nearby 1994 data locations for lead contamination. When these co-located samples are compared, it more clearly shows the stable nature of the sediments in the pond. This comparison does not necessarily need to replace the given information, but a section on uncertainty or perhaps risk managment should discuss this inconsistency and offer at least a qualitative comparison to the 1994 and 1992 data to allow an appropriate risk managment decision to be made.
Specifically, 1992 data locations SS-27, S-22, SS114, SS113, and SS07 are relatively co-located to 2005 locations PS01-04. These comparisons show that the only location that is a significant problem is SS-27 (and correspondingly PS-01). Similarly, 1994 data locations 407-8, 405, 402-3, and 400 are relatively co-located to 2005 locations PS01-04. These comparisons show a more significant decrease in lead concentrations along the entire stream.

6. Section 5.2.1, "Stream" 1st sentence: Data in table 3 do not show trends specifically. Rather, it shows a cutoff in concentrations at the outfall from building 790. The concentrations do not decrease as they move away from this outfall, but instead fluctuate until the pond is reached. Recommend changing the text to read "The results presented in Table 3 show a sharp decrease in mercury and lead concentrations corresponding to the location where previous sediment remediation projects have removed the source areas." or something similar.

7. Section 6.4 Fish Tissue: The percentage increase and decrease in fish tissue concentrations should not be stated without a clear description of the potential error in these values. More specifically, the statement that there has been a "63 percent decrease" in mercury concentrations suggests a degree of accuracy that is not true. The natural variability in the concentrations of the fish tissue is illustrated by Table 9. From October 92 to October 05, there were increases and decreases of 150%, 20%, 125%, and 63% in fish tissue concentrations. These values are not useful information on which to base a risk managment decision. A more useful description might be to evaluate how the fish tissue concentrations from 2005 compare to average values from October 92 to October 94 (0.15). I recommend that the percentages be taken out of the fish tissue sections and replaced by other qualitative or quantitative comparisons that are more useful to the risk managers.

8. Section 7.1 The low quality of the benthic community described in this section should also be summarized in the "uncertainty" or "risk management" section to be considered in making a decision regarding this site.

9. Section 8.0 Second bullet: Revise the conclusion that mercury and lead concentrations are higher in the pond to reflect the comment #5 on section 5.1.3 above.

10. Section 9.0 First bullet: Recommend removing the call for more investigation. Enough data has been collected at this

site for the partnering team to make a good risk managment decision about the future of this site. Futher analysis will likely not provide any additional information that will change a risk managment decision made at this point.

Work Plan for Additional Investigation at Sites 8 and 56, NDWIH, Indian Head, Maryland

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DATE: August 11, 2005

Introduction

This work plan presents the proposed approach for sampling sediment and fish tissue downgradient of Site 8, Mercury Contamination at Building 766, and Site 56, Lead Contamination at Industrial Wastewater (IW) Outfall 87. Both sites are located at the Naval District Washington, Indian Head (NDWIH), in Indian Head, Maryland.

This work plan supplements and references the following documents:

- ABB Environmental Services, May 1991. *Technical Memoranda – Site 8 Nitroglycerin Plant Office*, Indian Head Naval Ordinance Station, Indian Head, MD, Chapter 4 – Mercury Speciation Study.
- Brown and Root Environmental, July 1995. *Summary Biomonitoring Report for Site 8 – Nitroglycerine Plant Office, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland.*
- Brown and Root Environmental, February 1996. *Summary Biomonitoring Report for IR Site 56 – IW87 Lead Contaminated Outfall, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland.*
- CH2M HILL, June 2004. *Draft Desktop Evaluation for Site 8 – Mercury Contamination at Building 766, and Site 56 – Lead Contamination at Industrial Wastewater Outfall 87, Naval District Washington Indian Head* (herein referred to as DTE).
- CH2M HILL, April 2005. *Final Site Screening Process Investigation Work Plan for Sites 19, 26, 27, Wetland Area Adjacent to Site 45, and Stump Neck SWMUs 14 and 30* (herein referred to as the SSP Investigation Work Plan).

- Halliburton NUS, January 1993. *Site Characterization Report for Site 8 – Nitroglycerin Plant Office at Indian Head Division Naval Surface Warfare Center.*
- Halliburton NUS, April 1995. *Post Removal Action Report for Site 8 – Nitroglycerin Plant Office at Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland.*
- OHM Remediation Services Corporation, February 1997. *Draft Final Summary Report for Removal of Lead-Contaminated Soil at Site 56, Naval Surface Warfare Center, Indian Head, Maryland* (herein referred to as Site 56 Post-RA Report).
- Tetra Tech NUS, July 1999. *Remedial Investigation Report for Sites 12, 39/41, 42, and 44, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland* (herein referred to as the Site 12 RI Report).
- Tetra Tech, NUS, June 2004. *Master Plans for Installation Restoration Program Environmental Investigations, Naval District Washington, Indian Head, Indian Head, Maryland* (herein referred to as Master Work Plan).
- USEPA, October 2004. OSWER 9240.I-45, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Final (EPA 540-R-04-004).*

This work plan also incorporates discussions held during a March 8, 2005, teleconference with Naval Facilities Engineering Command (NAVAFAC) Washington, NDWIH, U.S. Environmental Protection Agency (EPA), EPA Biological Technical Assistance Group (EPA-BTAG), and CH2M HILL. The meeting discussion is summarized in "Sites 8 and 56 Desktop Evaluation (DTE) Technical Memorandum," dated March 8, 2005. The Maryland Department of the Environment (MDE) provided concurrence with the March 8, 2005, discussions in e-mail correspondence dated May 5, 2005.

Rationale for Field Investigation

The DTE summarized historical site usage, removal actions, and investigation results from Site 8, Site 56, and the downstream marsh/pond area. As described in the DTE, historic operations at Sites 8 and 56 released mercury and lead, respectively, into downstream stream channels and the marsh/pond area. Sediment removal actions were performed at Sites 8 and 56 in 1994 and 1996, respectively, to address lead and mercury in downstream sediments. Tables 1 and 2 summarize the residual mercury and residual lead concentrations, respectively, in sediment from different areas within Sites 8 and 56. The data presented are the most recent obtained from the various sources reviewed during preparation of the DTE.

From October 1992 until November 1995, whole-body fish samples and other aquatic organisms were collected from the pond and two control sites as part of a quarterly biomonitoring program. Samples collected between October 1992 and October 1994 were analyzed for mercury, and samples collected between April 1994 and November 1995 were analyzed for lead. During the biomonitoring program, the three fish species collected most frequently were brown bullhead (*Ameiurus nebulosus*), eastern mosquitofish (*Gambusia holbrooki*), and bluegill (*Lepomis macrochirus*). All fish of each species were combined and homogenized, with one analysis performed per composite species sample. Analytical results from the tissue analyses are presented in Table 3 (mercury) and Table 4 (lead).

Although mercury levels in the pond sediment samples were found to be higher than those at the control sites, there did not appear to be a corresponding increase in mercury levels detected in fish and other aquatic organisms at Site 8. Only one fish species, the eastern mosquitofish (*Gambusia holbrooki*), appeared to contain tissue concentrations of mercury that were above background, but predatory fish species (e.g., white crappie) in the Site 8 pond that feed on *Gambusia* did not contain elevated levels of mercury. There was no evidence to suggest that fish and wildlife at Site 8 were affected by mercury contamination. Similarly, biomonitoring data yielded no evidence of food chain biomagnification and no evidence to suggest that fish at Site 8 were affected by elevated levels of lead in the sediments.

The metals detected in fish tissue were found at low enough concentrations that the DTE recommended no further action for Sites 8 and 56. The team, however, agreed during the March 8, 2005, teleconference that additional investigation was warranted for the following reasons:

- Current sediment concentrations of lead and mercury should be determined for locations downstream of the Site 8 and Site 56 removal actions. Downstream sediment samples from the middle and lower sections of the main stream channel have not been collected since the sediment removal action was performed at Site 8 in 1994.
- Current fish tissue concentrations of mercury and lead should be assessed in the pond. Fish tissue samples from the pond have not been collected since the last biomonitoring study was performed, in November 1995.
- Current sediment concentrations of lead and mercury should be assessed in the pond. Sediment samples have not been collected from the pond since 1997.

The Indian Head Installation Restoration Team (IHIRT) will use the data to make a risk management decision for closure of Sites 8 and 56.

Objectives

The objectives for this additional investigation are to characterize current lead and mercury concentrations in:

- The middle and lower sections of the stream and the pond sediment and compare the results to historical concentrations to determine if the concentrations have changed
- Fish tissue from the pond and compare the results to historical concentrations to determine if the concentrations have changed and to assess bioavailability of lead and mercury in fish

Figure 1 shows the proposed locations for sediment and fish tissue sampling.

Scope of Work

Field activities to be conducted under this work plan are the following:

- Mobilization/demobilization
- Sediment sampling in the middle and lower sections of the stream
- Sediment sampling in the pond
- Fish tissue sampling in the pond

- Quality assurance/quality control (QA/QC) sampling
- Surveying of sample locations
- Decontamination of sampling equipment
- Investigation-derived waste (IDW) handling

Each of these activities is discussed in detail below.

Mobilization/Demobilization

Mobilization activities will be coordinated with the Navy and will include staking out sample locations and orienting field staff to the site. Prior to mobilization, CH2M HILL field personnel will review this work plan. The Navy will verify the accessibility of the investigation area (due to nearby site operations by NDWIH personnel). Demobilization will consist of following proper decontamination procedures for all personnel and equipment and making sure that the site is left in its original condition prior to mobilization.

Sediment Sampling in the Middle and Lower Sections of the Stream

Figure 1 shows the proposed locations of eight sediment samples in the middle and lower sections of the stream. These samples will be analyzed for total lead and total mercury using the EPA CLP Inorganics SOW ILM04 protocol.

Stream sediment samples will be biased toward areas where sediment deposition has occurred; these depositional areas will be selected as close as possible to their respective proposed sediment sampling locations, shown in Figure 1. If no apparent depositional areas are observed, this will be noted in the field log book, and the sediment sample will be collected from the proposed locations themselves.

Sediment samples will be collected using a hand core sampler with precleaned liner tubes and core catchers, if necessary. This methodology will ensure minimal loss of fine material from the upper sediment during sediment collection. The core liner will be inserted into the sediment to a depth of at least 6 inches and will be capped after insertion to prevent loss of the sample upon retrieval. After retrieval, the top 6 inches of the core will be extruded with a wooden dowel from the bottom end into a precleaned stainless steel bowl and homogenized. The samples will then be transferred to the sampling container, which will then be placed in a cooler with ice and stored at 4 degrees Celsius.

Sediment Sampling in the Pond

Figure 1 shows the proposed four sediment sample locations in the pond. The sediment samples will be analyzed for lead and mercury using the same methods described above for stream sediment samples.

Pond sediment samples will be collected using a hand core sediment sampler with precleaned core liner tubes and core catchers, if necessary. The sediment core sampler will be inserted into the pond sediments to a depth of at least 6 inches. Depending on the depth of water at each sample station, a T-handle with the necessary number of 5-foot extension rods will be used to reach the pond bottom. After retrieval, each sediment core will be extruded and processed as described above for the stream sediment samples, in order to capture the 0 to 6 inch sediment interval below the sediment-water interface. If insufficient

sample volume is recovered using the hand core sampler, then a Ponar grab sampler will be utilized to collect sediment samples from the pond.

Each sample will be placed in a stainless steel bowl, homogenized, and transferred to the sampling containers, which will then be placed in a cooler with ice and stored at 4 degrees Celsius.

Fish Tissue Sampling in the Pond

The sampling effort proposed below is designed to replicate the previous biomonitoring methodology to maximize data comparability. During the previous sampling, performed between 1992 and 1994, fish were collected with a variety of methods, including baited trap nets, baited minnow traps, monofilament gill nets, and electrofishing. The three fish species that were collected most frequently over the seven sampling events were brown bullhead, eastern mosquitofish, and bluegill. Seven other fish species were collected at various times during the biomonitoring, but only on one sampling date each. These species consist of carp, shiner (*Notropis sp.*), creek chubsucker (*Erimyzon oblongus*), mummichog (*Fundulus heteroclitus*), pumpkinseed (*Lepomis gibbosus*), warmouth (*Lepomis gulosus*), and white crappie (*Pomoxis annularis*).

The three fish species caught most frequently during previous sampling events—brown bullhead, eastern mosquitofish, and bluegill—will be targeted for collection during this sampling event. . These species will provide data for comparison with historical fish tissue data from the pond.

Figure 1 shows the location of the pond. Individual bluegill and bullhead samples will be collected from two areas of the pond: the northern portion of the pond, in the vicinity of sediment sample IS08PS02, and the southern end of the pond, near sediment sample IS08PS04 and the pond outlet. Four eastern mosquitofish samples will be collected from the pond in the same locations as the sediment samples.

Each sample of bullhead and bluegill will consist of one individual fish, assuming that the fish are large enough to provide sufficient tissue for a sample. Because of their smaller size, the bluegill may require more than one individual fish to provide sufficient tissue for laboratory analysis. Each eastern mosquitofish sample will consist of at least 10 individual fish. If insufficient fish tissue is collected at one or more of the sampling locations, then tissue collected from an adjacent sampling location will be composited to provide a sample for laboratory analysis. Midsize specimens will be collected for each species, avoiding very young and very old individuals, in order to get a good representation of the population. In the unlikely event that these species are not found during sampling, one or more of the other species collected historically will be collected preferentially over any new fish species encountered.

Fish will be collected using a combination of baited trap nets and baited minnow traps, and possibly an experimental mesh monofilament gill net. The trap nets and minnow traps will be placed near the shore in 1 to 3 feet of water and left overnight. Nontarget fish species will be recorded and released.

The length and weight of each fish constituting the composite species samples will be recorded. Each composite fish sample will be homogenized in the laboratory, and one

subsample of the homogenized whole-body composite will be analyzed from each species sample. The samples will be analyzed for total lead and total mercury, percent lipids, and percent moisture. Tissue samples will be analyzed for total lead and total mercury using the EPA CLP Inorganics SOW ILM04 protocol.

Sampling Frequency, QA/QC Samples, and Sample Handling

Table 5 presents the sample media, number of samples, and analyses for this investigation. The appropriate number of field QA/QC samples—including field blanks, equipment blanks, duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples—will be analyzed in addition to laboratory QA/QC samples. Table 6 presents the analytical procedures and the frequency at which field QA/QC samples will be collected. Tables 7 and 8 list the sample containers, preservatives, and holding times required for the intended analyses for the fish tissue and sediment samples. Samples will be labeled, handled, documented, packaged, and shipped as detailed in the Master Work Plan and utilizing the protocol from the remedial investigation. An equipment blank will be taken at the end of the sampling to demonstrate that decontamination of the equipment was acceptable.

Survey of Sample Locations

The horizontal locations (northing and easting coordinates) of the sediment samples will be surveyed with a portable global positioning system (GPS) unit. The horizontal locations will be referenced to the 1983 North American datum.

Decontamination of Sampling Equipment

All nondedicated sampling equipment will be decontaminated prior to sampling activities and after each use. To minimize the amount of liquid IDW, disposable liners will be used for sampling activities. Decontamination procedures are presented in the SOP provided in the Master Work Plan.

IDW Handling

A minimal amount of IDW, consisting entirely of decontamination fluids, will be generated during this sampling program. Decontamination fluids will be stored in 5-gallon buckets for sampling and disposed of in accordance with procedures set forth in the SSP Investigation Work Plan. All personal protective equipment used during sampling will be disposed of in the facility dumpsters.

Documentation

All sampling and field information will be documented in a field log book.

Data Comparison

Following laboratory analysis of the samples, a third-party data validator will validate the data. For each environmental medium sampled (stream sediment, pond sediment, and fish tissue), the validated data (or, "new data") will be compared against previous sampling data (or, "historical data") to assess comparability of the datasets. During the March 8, 2005, teleconference call, team members agreed that if the lead and mercury concentrations are lower than those from previous sampling events, this would suggest that there is no further impact from Sites 8 and 56 and no further action would be warranted for these sites.

However, if the concentrations are not lower than previous sampling results, then the team will have to make a risk management decision as to the path forward for these sites.

On the basis of discussions during an IHIRT Partnering Meeting on June 30, 2005, and a subsequent conference call on July 6, 2005, IHIRT agreed on a protocol for comparing new and historical datasets. Depending on the sample medium, the comparison protocol will comprise the Analytical Variability Evaluation or Statistical Comparison or both. These components are described in the paragraphs that follow.

Analytical Variability Evaluation

In order to determine if the new data are comparable to historical data, an analytical variability evaluation will be performed. The rationale for this procedure is laid out below.

USEPA has published guidelines for data validation of inorganic environmental samples under the CERCLA program (USEPA, 2004). In this document, USEPA establishes acceptable ranges of concentrations for duplicate laboratory analyses to account for variability in sampling and laboratory procedures, methods, instrumentation, and ambient conditions. The ranges are calculated using the relative percent difference (RPD) between the primary sample concentration and the duplicate sample concentration (see equation below).

$$RPD = ([S - D] / [S + D]/2) \times 100$$

where:

S = primary sample concentration
D = duplicate sample concentration

The RPD calculation does not apply when the concentrations are close to the reporting limit (lowest calibration point) or when both samples are nondetects, as the RPD between very small concentrations is much higher than between midrange concentrations. The guidance directs an upper range equal to the reporting limit for aqueous samples that is less than five times the reporting limit and an upper range equal to twice the reporting limit for soil samples less than five times the reporting limit.

Section VI.C of the USEPA document indicates an acceptable range of ±20 percent RPD for aqueous samples and ±35 percent RPD for soil samples. Concentrations that fall within these ranges are considered equally representative of the true concentration. Based on this guidance, an acceptable range of ±35 percent has been selected for sediment samples.

On the basis of the USEPA guidelines referenced above, an analytical variability evaluation will be performed on the new and historical datasets:

Use a change in concentration of ±35 percent, based on (1) maxima for pond sediment and fish tissue and (2) means for stream sediment, in decision rules as the margin for determining an increase in constituent concentrations. This margin accounts for the inherent variability associated with laboratory analysis, as well as the potential uncertainty associated with potential differences in the size and age of individual fish used in the composite sample.

Figure 2 presents a schematic of three possible outcomes stemming from a comparison of the new dataset to the historical dataset based on the ±35 percent variability of the analytical results described above. These possible outcomes are:

- Improbable increase in constituent concentrations
- Possible increase in constituent concentrations
- Probable increase in constituent concentrations

As described below, the outcome of this comparison will be used to recommend the appropriate next step at Site 8, Site 56, and the pond.

Statistical Comparison

Because a sufficient population of stream sediment samples will be collected during the investigation at Sites 8 and 56, new and historic stream sediment data will be statistically compared, in addition to the analytical variability evaluation described above.

The objective of the statistical comparison is to determine whether a statistically significant increase in lead or mercury has occurred since the historic samples were collected. The first step of the statistical analysis will be to determine whether the datasets are normally distributed. If the data are found to be normally distributed, then a Student's *t*-Test will be performed to determine if statistically significant increases in lead and mercury concentrations have occurred. If the data are not normally distributed, then a Wilcoxon Rank Sum Test will be performed to compare the data sets.

Data Comparison Summary

The analytical variability evaluation and statistical comparison methods described above are presented schematically in Figure 3. The following summarizes the comparison procedures for each environmental medium; these procedures will be followed for both lead and mercury concentrations.

- **Stream sediment samples**—Historical and new data will be compared using both the analytical variability evaluation on the mean concentrations and the statistical comparison procedures described above.
- **Pond sediment and fish tissue samples**—Historical and new data will be compared using the analytical variability evaluation on the maximum concentrations. (Each species of fish will be evaluated separately to determine whether any of the species have shown a probable increase in lead or mercury concentrations).

Data Evaluation

The results of the data comparison presented above will be used to recommend the appropriate next steps at Sites 8 and 56. The following paragraphs provide the decision logic that will be followed in performing this comparison to determine the appropriate site management decision for Site 8, Site 56, and the pond.

It should be noted that the decision logic presented in this work plan is intended neither to be overly prescriptive nor to anticipate every possible outcome stemming form the data comparison described above. The decision logic is intended to provide the recommended

path forward for Site 8, Site 56, and the pond to expedite IHIRT concurrence on the site management decisions for each of these locations. Regardless of the outcome of the data comparison, IHIRT will discuss the results of the comparison and reach consensus on the appropriate next step for each of the sites before any further steps are taken.

The following decision logic will be followed for both lead and mercury concentrations:

Step 1: Compare Mercury/Lead Concentrations in Fish Tissue and Pond Sediment

Four general outcomes exist when comparing current and previous mercury and lead concentrations in fish tissue and pond sediment:

- **Scenario A**—Concentrations in fish tissue have increased (i.e., possible or probable increase as defined in Figure 2), but concentrations in pond sediment have decreased from those in the historical dataset
- **Scenario B**—Concentrations in both fish tissue and pond sediment in the new dataset have increased from those in the historical dataset
- **Scenario C**—Concentrations in fish tissue have decreased, but concentrations in pond sediment have increased from those in the historical dataset
- **Scenario D**—Concentrations in both fish tissue and pond sediment have decreased from those in the historical dataset

Each of these scenarios is displayed schematically in Figure 4.

Step 2: Compare Mercury/Lead Concentrations in Stream Sediment

Once the appropriate scenario from step 1 has been determined, a comparison between the current and previous mercury/lead concentrations in the stream sediment will be performed to determine the appropriate next step for Sites 8 and 56. As shown in Figure 4, one or more of the following site management recommendations will be made at Sites 8 and 56 depending on the outcome of this second comparison:

- Sites 8 and 56 will be recommended for closure under any of the four scenarios from step 1 if maximum mercury or lead concentrations in stream sediment have decreased from those in the earlier dataset.
- A Screening Ecological Risk Assessment (SERA) will be performed for the stream and pond if either lead or mercury concentrations have increased in fish tissue and in stream sediments (possible under Scenario A or Scenario B). The results of the SERA will be used to guide risk management decisions for Sites 8 and 56.
- Further evaluation of historic fish data will be performed if either lead or mercury concentrations in fish tissue have increased, but concentrations have declined in the pond and stream sediments (Scenario A). The purpose of the evaluation will be to determine if the increase in fish tissue concentrations might be related to differences in age or size of fish collected. Under this outcome, Sites 8 and 56 will be recommended for closure.

- A source evaluation and SERA for the pond will be performed if lead or mercury concentrations in fish tissue and pond sediments have increased, but concentrations have declined in stream sediments (Scenario B). Under this outcome, Sites 8 and 56 would be recommended for closure, but additional evaluation of the pond would be required to identify whether other sources contributing to the lead or mercury concentrations might exist.
- Future biomonitoring will be performed if lead and mercury concentrations decline in fish tissue but increase in stream sediments. This outcome is possible under Scenario C (biomonitoring in the pond and stream) or Scenario D (biomonitoring only in the stream). This outcome would indicate that lead and mercury accumulation in the food chain has not increased but that a potential source is still present in the stream sediments, which would warrant future biomonitoring in the pond.

Data Reporting

Field activities, analytical results, data evaluation and interpretation, and recommendations based on the decision logic provided in Figure 4 will be presented in a technical memorandum for submittal to the IHIRT.

Standard Operating Procedures

Fieldwork will follow the standard operating procedures provided in the Master Work Plan and will be consistent with procedures described in the SSP Investigation Work Plan.

Health and Safety

Health and safety procedures will follow those described in the Master Work Plan, the CH2M HILL Master Health and Safety Plan for NDWIH, and the Sites 8 and 56 Specific Health and Safety Plan.

Schedule

Fieldwork is anticipated to occur in conjunction with field investigations for other sites. This work is planned for fall 2005.

TABLE 1
Residual Mercury Concentrations in Sediment, Sites 8 and 56
NDWIH, Indian Head, Maryland

Area Name	# Samples	Mean	Median	Range	Date Sampled	Source Report
Building 766 Area	3	0.19	0.03	ND—0.518	Aug. 1994	1995 Site 8 Post-RA Report
Upper Section of Stream	21	1.30	0.46	ND—8.65	Aug. 1994	1995 Site 8 Post-RA Report
Mid Section of Stream	18	0.39	ND	ND—0.48 K(m)	Sept. 1992	1993 Site Characterization Report
Lower Section of Stream	36	4.20	ND	ND—7.4 K(m)	Sept. 1992	1993 Site Characterization Report
Marsh/Pond Area	3	0.12	0.1	0.09—0.16	Oct. 1997	1999 Site 12 Remedial Investigation Report
Area Downstream of Noble Road	12	0.39	ND	ND—1.6	Sept. 1992	1993 Site Characterization Report

All units are in milligrams/kilogram (mg/kg)
ND—Value is non-detect as reported by the laboratory
K(m)—Positive result is estimated and biased high due to high matrix spike recovery
Mean is calculated as average of all normal samples; nondetect values were included in the mean as one half the nondetect (U-flagged) analytical result.

TABLE 2
Residual Lead Concentrations in Sediment, Sites 8 and 56
NDWIH, Indian Head, Maryland

Area Name	# Samples	Mean	Median	Range	Date Sampled	Source Report
Mid Section of Stream	1	8.73	8.73	8.73*	May 1994	April 1994 Biomonitoring Report
IW-87 Outfall Area	14	10.2	8.65	2.6—20.5	Sept. 1996	1997 Site 56 Post-RA Report
Lower Section of Stream	4	530	636	40.6—811	May 1994	April 1994 Biomonitoring Report
Marsh/Pond Area	3	40	39.6J	28.1J—52.2J	Oct. 1997	1999 Site 12 Remedial Investigation Report

* Only one sample was collected in 1994.

All units are in milligrams per kilogram.
ND—Value is nondetect as reported by the laboratory
K(m)—Positive result is estimated and biased high due to high matrix spike recovery.
Mean is calculated as average of all normal samples; nondetect values were included in the mean as one half the nondetect (U-flagged) analytical result.

TABLE 3
Historical Mercury Concentrations in Fish Tissue, Site 8
NDWIH, Indian Head, Maryland

Species	Oct 92	Jan 93	Apr 93	Jul 93	Oct 93	Apr 94	Oct 94
Brown bullhead *	0.04 (3)			0.05 (2)	0.05 (1)		***0.06 (2)***
Mosquitofish*	0.06 (16)	0.15 (4)			0.12 (36)		***0.27 (75)***
Bluegill *	0.02 (11)	0.02 (6)	0.06 (1)	***0.09 (2)***		0.07 (3)	0.07 (4)
Gizzard shad	—	—	—	—	—	—	—
Goldfish	—	—	—	—	—	—	—
Common carp	—	—	—	—	—	—	—
Creek chubsucker	—	0.03 (1)	—	—	—	—	—
Largemouth bass	—	—	—	—	—	—	—
Largemouth bass	—	—	—	—	—	—	—
White crappie	—	—	—	—	—	—	0.06 (2)
Black crappie	—	—	—	—	—	—	—
Pumpkinseed	—	—	—	—	—	0.09 (3)	—
Carp	—	—	—	—	—	0.03 (2)	—
Shiner	—	—	—	—	0.05 (4)	—	—
Mummichog	—	—	0.03 (8)	—	—	—	—
Warmouth	—	—	—	0.23 (1)	—	—	—
Crayfish	—	—	—	0.07 (2)	0.09 (4)	—	—

All units in mg/kg.
Parentheses indicate the number of fish composing the sample that was analyzed.
* Fish species targeted for sampling during the 2005 investigation. The maximum concentration for each species is shown in bold and italics.

Data are from *Summary Biomonitoring Report for Site 8—Nitroglycerin Plant Office*, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland, July 1995.

TABLE 5
Sampling and Analysis Summary, Sites 8 and 56
NDWIH, Indian Head, Maryland

Media	Number of Samples	Analysis/ Method	Procedures
Sediment in Middle and Lower Sections of the Stream	8	Mercury, Lead, and Percent Moisture by CLP ILM04	Obtain sediment samples with a hand core sediment sampler
Sediment in the Pond	4	Mercury, Lead, and Percent Moisture by CLP ILM04	Obtain sediment samples with a hand core sediment sampler
Fish Tissue in the Pond	8	Mercury, Lead, and Percent Moisture by CLP ILM04* Percent Lipids	Catch fish using a combination of baited fish traps, baited minnow traps, and possibly an experimental mesh monofilament gill net.

*Tissue laboratory may not be able to perform the CLP ILM04 method and may request lead, mercury, and percent moisture by SW846.

TABLE 6
Summary of Samples to be Submitted for Analysis, Sites 8 and 56
NDWIH, Indian Head, Maryland

Matrix	Laboratory Parameter (Method)	Samples	Field Duplicates[1]	Field Blanks[2]	Equipment Blanks[3]	Trip Blanks	Solids Total	Aqueous Total	MS/ MSDs[4]
Sediment in Middle and Lower Sections of the Stream	Lead, Mercury, and Percent Moisture by CLP ILM04	8	1	1	1	—	9	2	1/1
Sediment in the Pond	Lead, Mercury, and Percent Moisture by CLP ILM04	4	1	—	—	—	5	—	—
Fish Tissue in the Pond[5]	Lead, Mercury, and Percent Moisture by CLP ILM04[6]	8	1	—	—	—	9	—	1/1
	Percent lipids	8	—	—	—	—	8	—	1/1

[1]Field duplicates are collected at a rate of 1 per 10 samples per matrix. Field duplicates will be collected from one fish species rather than from all three species that are sampled.

[2]Field blanks are collected at a rate of 1 per sampling event per week.

[3]One equipment blank is collected at the beginning of the sampling event to show that decontamination procedures were acceptable.

[4]Matrix Spikes/Matrix Spike Duplicates (MS/MSDs) are collected at a frequency of 1 per 20 per matrix. MS/MSDs represent samples for which extra volume must be collected for the laboratory to perform required QC analyses. Triple the normal volumes will be collected for all analyses.

[5]Up to eight fish tissue samples will be collected: 2 individual bluegill samples, 2 individual bullhead samples, and 4 composite eastern mosquitofish samples. Fewer than 8 samples will be collected if insufficient numbers of fish are caught during the sampling effort. Other fish species will be collected if bluegill, bullhead, or eastern mosquitofish are not encountered.

[6]Tissue laboratory may not be able to perform the CLP ILM04 method and may request lead, mercury, and percent moisture by SW846.

TABLE 7
Summary of Required Containers, Preservatives, and Holding Times for Sediment and Fish Tissue Samples,
Sites 8 and 56
NDWIH, Indian Head, Maryland

Sampling Medium	Parameters	Container Type	Preservation	Holding Time	Notes
Sediment (middle and lower sections of the stream and Pond)	Mercury, Lead, and Percent Moisture	One 8-oz jar	Cool to 4°C	6 months (28 days for Mercury)	All parameters can be analyzed from the same 8-oz jar
Fish Tissue (Pond)	Mercury, Lead, Percent Moisture, Percent Lipids	2 quart zip-lock bags (double bagged)*	Cool to 4°C	6 months (28 days for Mercury)	Composite sample generated in lab; field duplicate collected from composite sample in lab

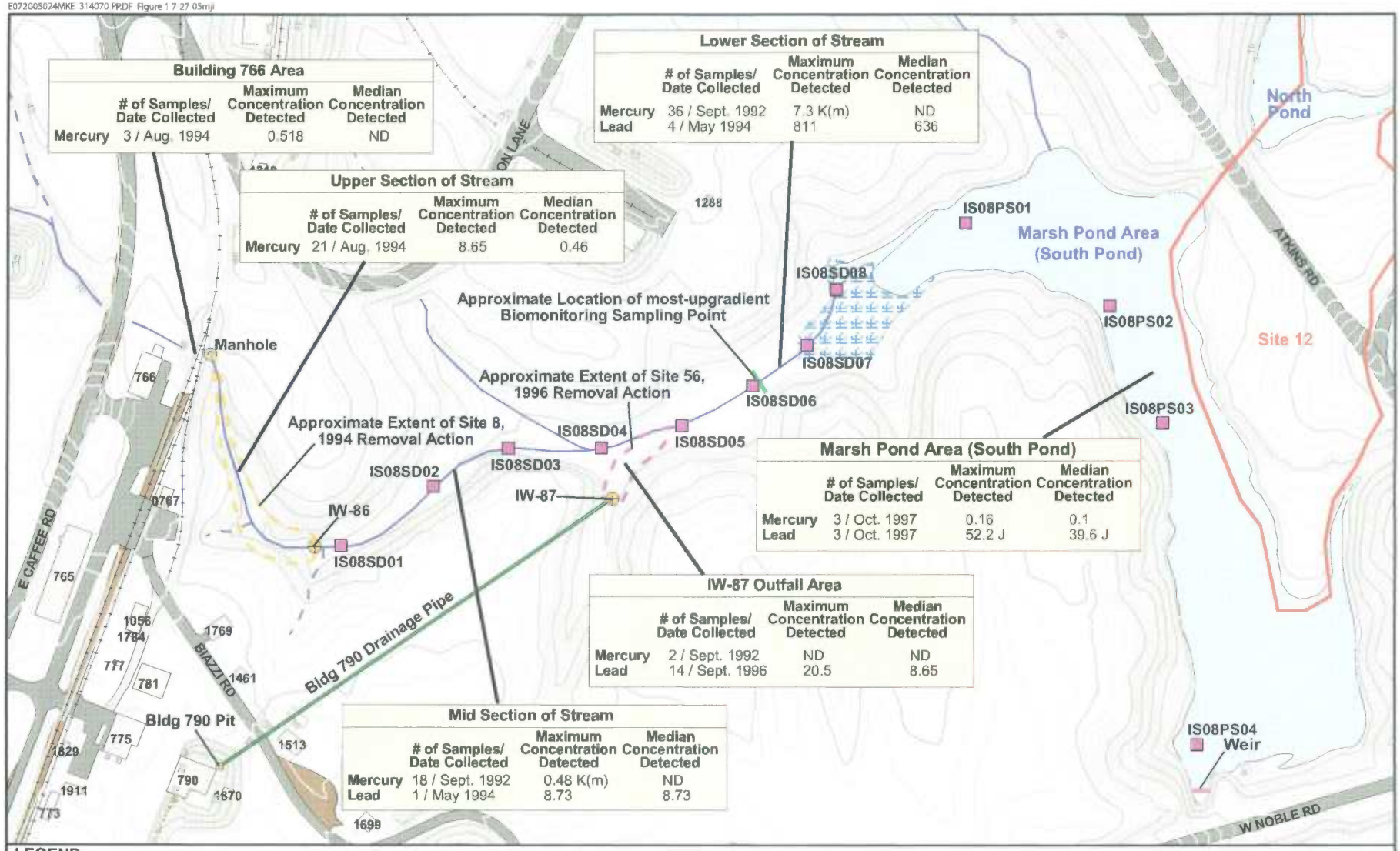
* Ice in between and around bags

TABLE 8
Summary of Required Containers, Preservatives, and Holding Times for Liquid Samples, *Sites 8 and 56*
NDWIH, Indian Head, Maryland

Parameter	Container Type	Preservation	Holding Time
Lead and Mercury by CLP ILM04	One 500-mL plastic	Nitric acid to pH <2 and cool to 4°C	6 months (28 days for mercury)

Figures

E072005024MKE 314070 PPDF Figure 1 7 27 05mjl



All results in mg/kg (milligrams per kilogram)
ND - Non Detect
K(m) - Positive result is estimated and biased high due to high matrix spike recovery
J - Analyte was positively identified but the quantitation is an estimate

Figure 1
Sediment Sample Locations
Sites 8 and 56 Work Plan
NDWIH, Indian Head, Maryland

CH2MHILL

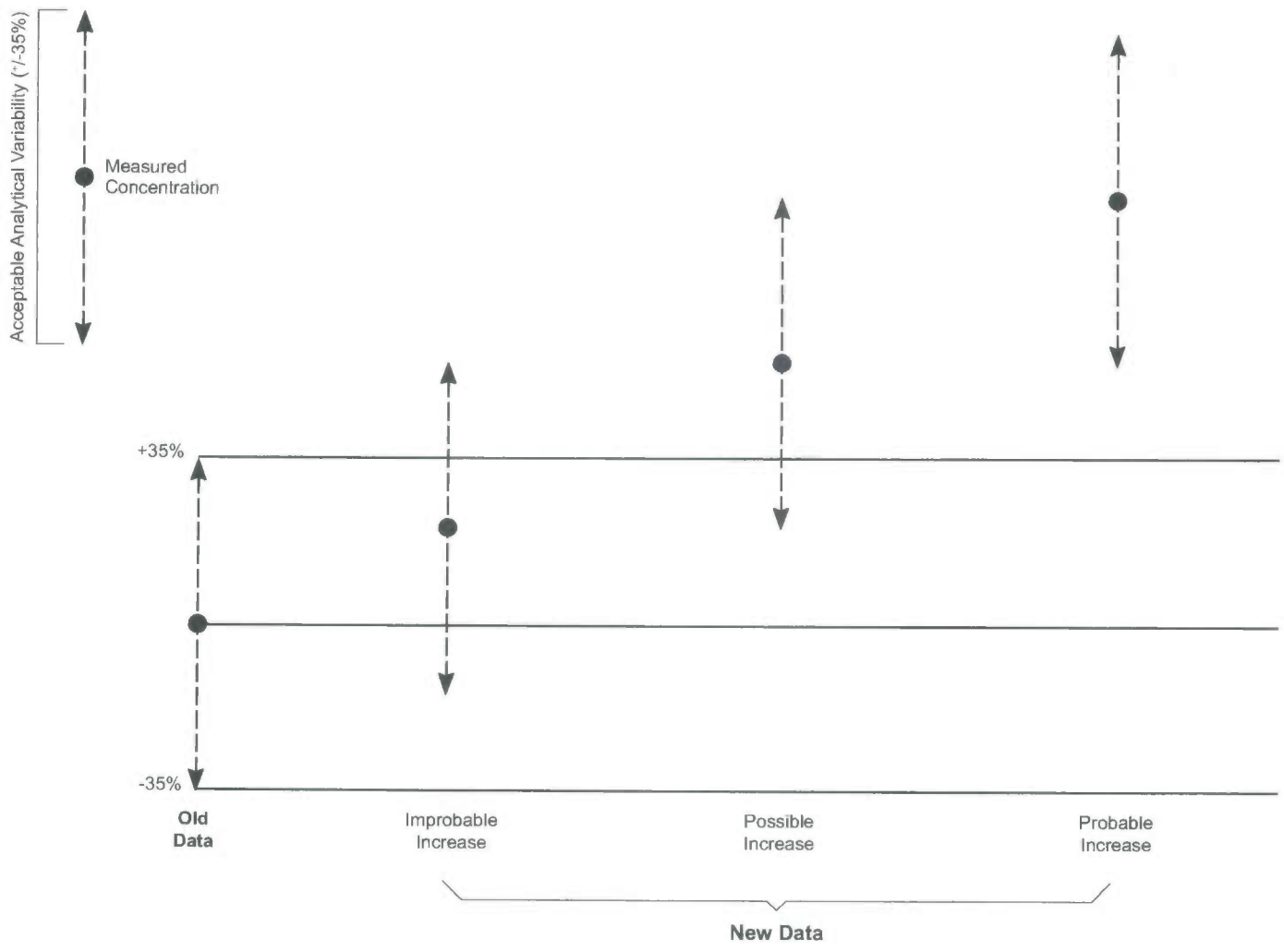


Figure 2
Comparison of Constituent Concentrations
in New Datasets to Historical Dataset
Sites 8 and 56 Work Plan
NDWIH, Indian Head, Maryland

CH2MHILL

E072005024MKE Figure 2_v2 07-29-05mjl/jls

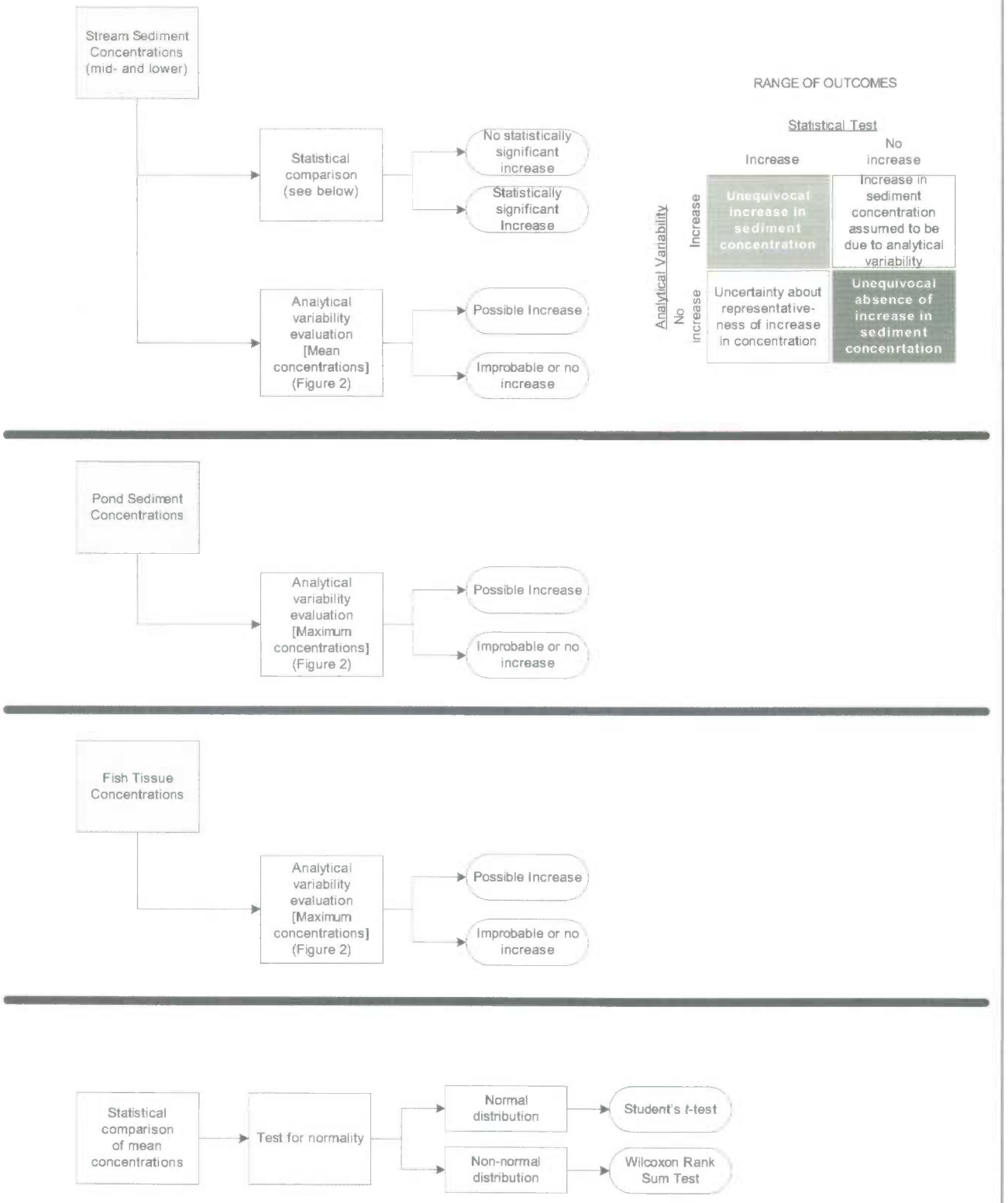
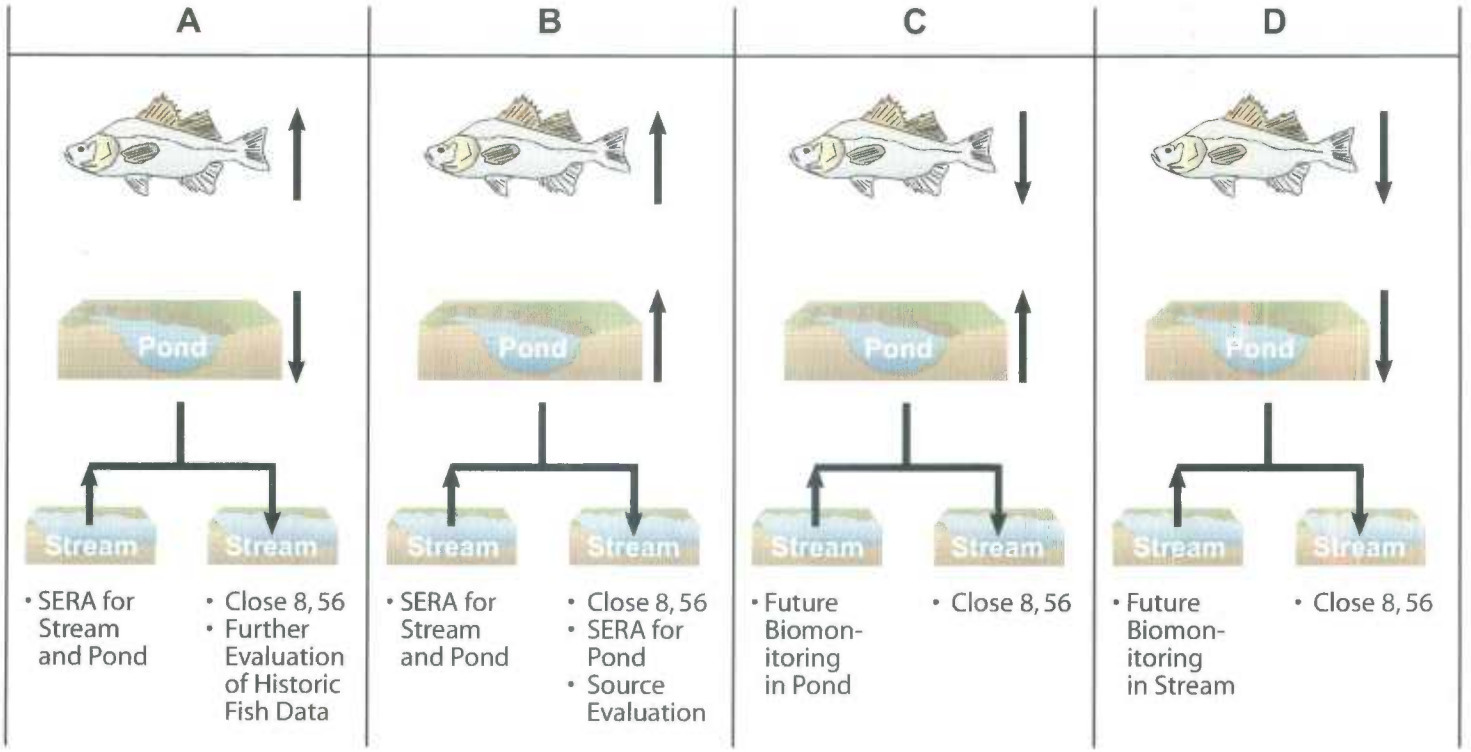


Figure 3
Proposed Data Comparison Approach for Stream Sediment, Pond Sediment, and Fish Tissue Samples
Sites 8 and 56 Work Plan
NDWIH, Indian Head, Maryland

CH2MHILL



Possible or probable increase in concentration

Decreasing concentration

Stream — Lead or Mercury concentration in stream sediment

Lead or Mercury concentration in fish tissue

Pond — Lead or Mercury concentration in pond sediment

Figure 4
Decision Logic for Recommending the Next Steps at Site 8, Site 56, and Pond
Sites 8 and 56 Work Plan
NDWIH, Indian Head, Maryland

CH2MHILL

E072005024MKE 314070 PP.DF Figure 4_v2.ai 7-29-05 mjl/jls

Responses to Comments on Work Plan for Additional Investigation at Sites 8 and 56, NDWIH, Indian Head, Maryland

PREPARED FOR: Shawn Jorgensen/NDWIH
Jeff Morris/NAVFAC Washington
Joe Rail/NAVFAC Washington
Curtis DeTore/MDE
Dennis Orenshaw/EPA Region III
Simeon Hahn/BTAG

PREPARED BY: Rebecca Losli/CH2M HILL
Chris English/CH2M HILL

COPIES: Scott Saroff/CH2M HILL
Margaret Kasim/CH2M HILL
Rebecca Losli/CH2M HILL

DATE: August 11, 2005

This memorandum provides responses to comments on the document referenced above. The work plan was submitted electronically to IHIRT on May 26, 2005. Comments on the document were received electronically from NAVFAC Washington and NDWIH on June 3, 2005. These comments, as well as technical input from EPA, BTAG, and MDE, were discussed during an IHIRT Partnering Meeting on June 30, 2005. A subsequent teleconference was held on July 6, 2005 among IHIRT members to discuss remaining comments on the work plan. One final technical issue was discussed between CH2M HILL and BTAG on July 22, 2005.

The responses provided below pertain to the comments received by NAVFAC Washington and NDWIH. These responses, as well as subsequent discussions with IHIRT, have been incorporated into a final version of the work plan that is being submitted concurrently with these responses.

Comments are presented as received, followed by CH2M HILL responses shown in italics. Please review the responses to ensure they address your comments.

Comments from NAVFAC Washington

General

1. The pond is generally referred to in the document as the "tidal pond"—since there is now a weir separating the pond from the tidal Mattawoman, this nomenclature may be inappropriate.

   Response: *Throughout the work plan text, tables, and figures, all references to "tidal pond" have been changed to "pond."*

Rationale for Field Investigation

2. Pages 2, 3—The inclusion of actual inorganic concentrations without any risk discussion, followed by the statement on the NFA recommendation, create an information gap. There may not be any added value from the mention of the concentrations here. A general acknowledgement that the metals were detected in fish tissue at low enough levels to support the NFA recommendation could suffice. The actual concentrations might be better located in a table, as was done for the sediment.

   Response: *To address this comment, the following paragraph has been added after the second paragraph in the Rationale for Field Investigation section of the document. This paragraph summarizes the conclusions of the previous biomonitoring events at Sites 8 and 56:*

   > Although mercury levels in the pond sediment samples were found to be higher than those at the control sites, there did not appear to be a corresponding increase in mercury levels detected in fish and other aquatic organisms at Site 8. Only one fish species, the eastern mosquitofish (*Gambusia holbrooki*), appeared to contain tissue concentrations of mercury that were above background, but predatory fish species (e.g., white crappie) in the Site 8 pond that feed on *Gambusia* did not contain elevated levels of mercury. There was no evidence to suggest that fish and wildlife at Site 8 were affected by mercury contamination. Similarly, biomonitoring data yielded no evidence of food chain biomagnification and no evidence to suggest that fish at Site 8 were affected by elevated levels of lead in the sediments.

   As recommended in the comment above, mercury and lead concentrations have been tabulated in new Tables 3 and 4, respectively. All subsequent tables in the work plan will be renumbered.

Sediment Sampling in the Middle and Lower Sections

3. Page 4, 1st paragraph—Simeon typically likes us to sample in depositional areas of the stream. The locations chosen appear to be equally spaced throughout the stream. You might want to consider either 1) biasing the samples to depositional areas in each reach of the stream or 2) looking for depositional areas located relatively close to the planned sample locations.

   Response: *To address this comment, the following text has been added to the work plan as the second paragraph in the Sediment Sampling in the Middle and Lower Sections of the Stream subsection in the Scope of Work section:*

   > Stream sediment samples will be biased toward areas where sediment deposition has occurred; these depositional areas will be selected as close as possible to their respective proposed sediment sampling locations, shown in Figure 1. If no apparent depositional areas are observed, this will be noted in the field log book, and the sediment sample will be collected from the proposed locations themselves.

Fish Tissue Sampling in the Tidal Pond

4. Page 5, 4th paragraph—The fish (brown bullhead, mosquitofish, and bluegill) don't have strong site fidelity in one area of the pond. It's likely that the fish in the pond range into all areas during their life cycles. Consequently, it may not be necessary to collect fish samples from the northern and southern areas, and instead just collect 6 samples from the pond. The team doesn't appear to be making decisions within the pond

(northern/southern), so it might be easier on the fish collectors to lift the area restrictions on the fish.

Response: *This comment was discussed among IHIRT members during the Partnering Meeting on June 30, 2005, and again between CH2M HILL and BTAG in a teleconference on July 22, 2005. Based on the meeting and teleconference, the following approach was agreed upon and has been inserted into the Work Plan:*

A. *Up to four composite mosquitofish samples will be collected from the pond. These sampling locations will be colocated with the four sediment sampling locations in the pond. If insufficient fish tissue is collected at one or more of the sampling locations, then tissue collected from adjacent sampling locations will be composited to provide a sample for analysis.*

B. *Two bullhead and two bluegill samples will be collected, one of each species from the northern portion of the pond, and one of each species from the southern portion of the pond. Each sample will be comprised of one individual fish, assuming that the fish are sufficiently large to provide sufficient tissue for a sample. Because of their smaller size, the bluegill sample may require more than one individual fish to provide sufficient tissue for laboratory analysis. If this is the case, then multiple bluegills will be composited to provide sufficient tissue for the sample.*

The approach outlined above will result in a total of eight fish tissue samples: four mosquitofish, two bullheads, and two bluegills.

IDW Handling

5. Page 6—Verify it is okay to dump the PPE from the collections into the facility dumpsters.

Response: *In an e-mail dated June 6, 2005, Shawn Jorgensen of NDWIH confirmed that PPE can be bagged and placed into dumpsters at NDWIH.*

Data Evaluation

6. Page 7, 1st bullet—The +30% value is still within the laboratory margin of error (35% listed under bullet #2). It might be better to make sure that you are out of the "gray area" and choose +40% or +50% instead (esp. in the pond, where the mean historical mercury levels are very low.)

   Also: Why base the decision on maximum values and not mean values? At the very least, both should be considered—as any eventual risk evaluations will be based off the mean (or 95% UCL on the mean).

   Response: *This comment was discussed by IHIRT members during the Partnering Meeting on June 30, 2005, and during a teleconference call on July 6, 2005. Based on the outcome of these discussions, 35 percent, rather than 30 percent, will be used as the metric for assessing analytical variability.*

   On July 6, 2005, IHIRT also agreed that maximum values will be used for comparison of fish tissue to pond sediment concentrations, whereas mean values will be used for comparison of historic to new stream sediment concentrations. Because a sufficient number of stream sediment samples will be collected during the upcoming investigation, IHIRT agreed that a statistical

analysis will be performed on the historic and new stream sediment lead and mercury data. The objective of the statistical analysis is to determine if a statistically significant increase in lead or mercury has occurred since the historic samples were collected. The first step of the statistical analysis will be to determine whether the datasets are normally distributed. If the data are found to be normally distributed, then a Student's t-Test will be performed to determine if statistically significant increases in lead and mercury concentrations have occurred. If the data are not normally distributed, then a Wilcoxon Rank Sum Test will be performed to compare the data sets.

The analytical variability evaluation and statistical comparison methods described above are presented schematically in a new figure (Figure 3) that has been added to the work plan.

7. Page 8, 1st (partial) paragraph—Since you don't have historical methyl mercury data, it might be useful to have a "reference" area. For example, the team could take a soil sample at Site 8 (or maybe an upstream sediment location - with similar grain size and TOC) and analyze it for mercury and methyl mercury? It might be important to establish a "reference level" of methyl mercury in the stream since the screening levels are so low.

   Response: *During the IHIRT Partnering Meeting on June 30, 2005, the IHIRT agreed that methyl mercury will not be analyzed during the upcoming investigation at Sites 8 and 56. As a result, references to methyl mercury with respect to the upcoming sampling event have been removed from the Work Plan.*

Step #1 Compare Mercury/Lead Concentrations in Fish Tissue

8. Page 8, Scenario A—Is there a decision point for if there is a difference in increase/decrease of mercury by species of fish? For example, what if the concentration of mercury in the fish tissue goes up in bullhead, but down in mosquitofish? Would this default to "A" or would it be "B"? The team might want to consider establishing this ahead of time.

   Response: *Each species of fish will be evaluated separately to determine whether any of the species has shown a probable increase in lead or mercury concentrations. If there is an increase in any of the three target species, then the decision logic corresponding to an increase in fish-tissue concentration will be followed.*

Step #2 Compare Mercury/Lead Concentrations in Stream Sediment

9. Page 8, 2nd bullet—You might want to reconsider performing a SERA for the sediments. The stream will most likely fail. (As the Hg screening levels are very low [.15 ppm] as are the levels for lead [46.7ppm]). Perhaps a BERA would be better, although it would be a more in-depth document (although perhaps just through step 3A). It will boil down to the comfort level of our team regarding making risk management decisions.

   Response: *During the July 6, 2005, teleconference call, IHIRT agreed that if an ecological risk assessment were deemed necessary, a SERA would be performed to determine if a BERA should be conducted.*

10. Page 9, 1st bullet on page—The difference in species might also contribute to differing values (see comment #8, above).

Response: *As stated in the response to Comment #8 above, each species of fish will be evaluated separately to determine whether any of the species have shown a probable increase in lead or mercury concentrations. If there is an increase in any of the three target species, then the decision logic corresponding to an increase in fish-tissue concentration will be followed.*

Table 1

11. Page 10—For the mid-section of the stream, the mean is listed as 1.05 ppm, but the range is ND to 0.48 ppm. This is probably supposed to be 4.8 ppm, but the numbers should be checked.

    Response: *The mean was incorrectly determined using nondetect and detected values. The mean has been changed to 0.39 ppm. The maximum value of 0.48 ppm is correct.*

Overall Comment

12. The DQOs are great...this is a perfect way to quickly set up the decision rules and iron out how the data will be used.

    Response: *Comment noted. It was observed that the DQOs facilitated discussions among the IHIRT members on June 30 and July 6, 2005, allowing the team to quickly reach consensus on the overall investigation objectives and on the decision logic for determining the recommended next steps based on the data that will be obtained from the upcoming investigation.*

Editorial

13. Page 1, 1st paragraph "Both sites are at located the Naval District..." - switch "at" and "located".

    Response: *This change has been made as suggested.*

Comments from Shawn Jorgensen/NDWIH

1. Pages 1 and 2, Introduction, reference bullets. Please add the month that the documents were prepared to the end of the reference.

   Response: *All months have been added to the reference bullets as suggested.*

2. Page 1, Introduction, first reference document (the 6 site SSP Investigation Work Plan). Why is this referenced for this Site 8 and Site 56 Work Plan?

   Response: *This reference is cited in the discussion of Investigation Derived Waste (IDW) handling procedures.*

3. Page 2, Introduction, fifth bullet on page. Change "Halliburton NUS Corporation" to "Brown & Root Environmental." Brown & Root was the company's name that prepared the Biomonitoring Report. They just happen to have been part of the Halliburton NUS Corporation at the time.

   Response: *This change has been made as suggested.*

4. Page 2, Introduction, fourth bullet on page. Why is the RI Report for Sites 12, 39/41, 42, and 44 referenced for this Site 8 and Site 56 Work Plan?

Response: *This document is listed as a source report in Table 2 and should be included in the references.*

5. Page 2, Introduction, references. Please add the following references:
   A. Brown & Root Environmental, 1996. Summary Biomonitoring Report for IR Site 56 - IW87 Lead Contaminated Outfall, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland. February

   B. ABB Environmental Services, 1991. Technical Memoranda - Site 8 Nitroglycerin Plant Office, Indian Head Naval Ordnance Station, Indian Head, MD, Chapter 4 - Mercury Speciation Study. May

   Please note that I have placed electronic copies of these references on the CH2M HILL ftp site, under Indian_Head\ChrisEnglishDocuments for your use. They will be discussed in my comments below.

   Response: *Reference A above has been added to the reference list and is cited in Tables 3 and 4, which provide historical mercury and lead concentrations in fish tissue. Reference B has not been added because methyl mercury analysis has been removed from the scope of the investigation at Sites 8 and 56 (see response to NAVFAC Washington's Comment #7 above).*

6. Page 2, Introduction, third bullet, second line. A comma is needed between "... Annex" and "Naval Surface Warfare..."

   Response: *This change has been made as suggested.*

7. Page 3, first paragraph on page. Please note that fish tissue sampling was conducted for lead in October 1993, April 1994, October 1994, August 1995, and November 1995, as summarized in the document 5A above (Summary Biomonitoring Report for IR Site 56). The maximum values for lead in the fish in the tidal pond included 1.6 mg/kg for Gizzard Shad in August 1995 and 1.2 mg/kg for Brown Bullhead in November 1995. This will change the information presented in this paragraph.

   Response: *As noted in our response to NAVFAC Washington's Comment #2 above, mercury and lead concentrations have been tabulated in new Tables 3 and 4, respectively.*

   With the addition of Tables 3 and 4, the discussion of numerical results has been removed from the text. The paragraph deleted was the second paragraph in the Rational for Field Investigation section. The first sentence of this paragraph was revised to provide an introduction to the data contained in the new Tables 3 and 4.

   To address the comment above, the second and third paragraphs under "Rationale for Field Investigation" (last paragraph on Page 2 and first paragraph on Page 3) have been replaced with the following text:

   > From October 1992 until November 1995, whole-body fish samples and other aquatic organisms were collected from the pond and two control sites as part of a quarterly biomonitoring program. Samples collected between October 1992 and October 1994 were analyzed for mercury, and samples collected between April 1994 and November 1995 were analyzed for lead. During the biomonitoring program, the three fish species collected most frequently were brown bullhead (*Ameiurus nebulosus*), eastern mosquitofish (*Gambusia holbrooki*), and bluegill (*Lepomis*

macrochirus). All fish of each species were combined and homogenized, with one analysis performed per composite species sample. Analytical results from the tissue analyses are presented in Table 3 (mercury) and Table 4 (lead).

Although mercury levels in the pond sediment samples were found to be higher than those at the control sites, there did not appear to be a corresponding increase in mercury levels detected in fish and other aquatic organisms at Site 8. Only one fish species, the eastern mosquitofish (*Gambusia holbrooki*), appeared to contain tissue concentrations of mercury that were above background, but predatory fish species (e.g., white crappie) in the Site 8 pond that feed on *Gambusia* did not contain elevated levels of mercury. There was no evidence to suggest that fish and wildlife at Site 8 were affected by mercury contamination. Similarly, biomonitoring data yielded no evidence of food chain biomagnification and no evidence to suggest that fish at Site 8 were affected by elevated levels of lead in the sediments.

8. Page 4, Sediment Sampling. Just a note to let you know that hand core sampling may be problematic in some areas in the pond. I recall that the contractor had difficulty in some areas keeping the sediment in the core sampler when removing it from the pond. The sediment was very loose in those areas and just fell out of the sampler. You may want to consider an alternative method, just in case you run into the same problem trying to obtain sediment samples. Bottom line: Be prepared!

   Response: *If insufficient sample volume is recovered using the hand core sampler, then a Ponar grab sampler will be utilized to collect sediment samples from the pond. This alternate sediment collection method has been included in the Sediment Sampling in the Pond subsection of the Scope of Work section.*

9. Page 8, first paragraph on page, last sentence. Analytical results for methyl mercury in the following areas exist in the Mercury Speciation Study of this area that was conducted in 1987 and documented in the Technical Memoranda for Site 8 (reference document listed in 5B above): a) Upper Portion of Stream, b) Stream, c) Mattawoman Creek, D) Tidal Pond, E) Floodplain Soil, and F) Background Soil. The document contains a figure (Figure 4-1) showing the sample locations, and a table (Table 4-1) of results. The table includes values for Elemental Mercury, Methyl Mercury, Ionic Mercury, Bound Mercury, Mercuric Sulfide, Estimated Total Mercury, and Measured Total Mercury. A copy of this reference document has been placed on the CH2M HILL ftp site under Indian _Head\ChrisEnglishDocuments for your use.

   Response: *During the IHIRT Partnering Meeting on June 30, 2005, IHIRT agreed that samples will not be analyzed for methyl mercury. As a result, references to methyl mercury have been removed from the work plan.*

10. Figure 1. Please correct the spelling of "Weir" in the figure. In addition, I recall two hits of mercury in the tidal pond that were above the Site 8 cleanup level of 10 mg/kg for the 1994 Site 8 removal action. The values were 11 mg/kg and 13 mg/kg mercury. If my memory serves me, these values were detected when the transect sediment sampling (7 transects with 3 sampling locations per transect) was conducted in the pond as part of the original Site 8 Biomonitoring Study and the samples were located approximately mid-to-upper pond (north-south) at a sample location on the end of a transect. However, I don't see a maximum of 13 mg/kg mercury shown on the figure.

Response: *The spelling of "weir" will be corrected in Figure 1.*

The samples referenced in the comment were collected in 1992 during the Site 8 Site Characterization Study. The highest mercury concentrations in sediment were observed at SS-114 (11.4 mg/kg) and SS-113 (13.4 mg/kg). These results were not presented in the Sites 8 and 56 Work Plan because more recent (post-1994 removal action) sediment data were collected in 1997 as part of the Remedial Investigation (RI) at Site 8.

The middle two pond sediment sampling locations, IS08PS02 and IS08PS03, shown in Figure 1 roughly correspond to locations SS-113 and SS-114, the locations with the highest mercury concentrations.

It should be noted that for sample nomenclature, the station identification and sample identification are the same at each sample location, as shown on Figure 1. Pond sediment samples have been named IS08PS01 (northernmost sample) through IS08PS04 (southernmost sample). Pond sediment sample IS08PS02 will be collected near SS-114, while IS08PS03 will be collected near SS-113. As noted in the work plan, mercury concentrations measured in sediment will be compared against the values obtained from samples collected in 1997 during the RI at Site 12 (maximum concentration of 0.16 mg/kg).

11. Please note that some of my comments will affect the comments made by NAVFACWASH, in particular, their comment #7 concerning methyl mercury, since the data does exist.

Response: *Because methyl mercury will not be included in the upcoming field investigation, the mercury speciation data will not be included in the work plan.*

Comments on
Draft Work Plan
For Additional Investigation at Sites 8 and 56,
NDWIH, Indian Head, Maryland
Prepared by NAVFAC Washington
June 1, 2005

These comments were generated following review of the draft Work Plan for Sites 8 and 56.

General

1) The pond is generally referred to in the document as the "tidal pond" - since there is now a weir separating the pond from the tidal Mattawoman this nomenclature may be inappropriate.

Rationale for Field Investigation

2) Pages 2, 3 - The inclusion of actual inorganic concentrations without any risk discussion, followed by the statement on the NFA recommendation, create an information gap. There may not be any added value from the mention of the concentrations here. A general acknowledgement that the metals were detected in fish tissue at low enough levels to support the NFA recommendation could suffice. The actual concentrations might be better located in a table, as was done for the sediment.

Sediment Sampling in the Middle and Lower Sections

3) Page 4, 1st paragraph - Simeon typically likes us to sample in depositional areas of the stream. The locations chosen appear to be equally spaced throughout the stream. You might want to consider either 1) biasing the samples to depositional areas in each reach of the stream or 2) looking for depositional areas located relatively close to the planned sample locations.

Fish Tissue Sampling in the Tidal Pond

4) Page 5, 4th paragraph - The fish (brown bullhead, mosquitofish, and bluegill) don't have strong site fidelity in one area of the pond. It's likely that the fish in the pond range into all areas during their life cycles. Consequently, it may not be necessary to collect fish samples from the northern and southern areas, and instead just collect 6 samples from the pond. The team doesn't appear to be making decisions within the pond (northern/southern), so it might be easier on the fish collectors to lift the area restrictions on the fish.

IDW Handling

5) Page 6 - Verify it is okay to dump the PPE from the collections into the facility dumpsters.

Data Evaluation

6) Page 7, 1st bullet - The +30% value is still within the laboratory margin of error (35% listed under bullet #2). It might be better to make sure that you are out of the "gray area" and choose +40% or +50% instead (esp. in the pond, where the mean historical mercury levels are very low.) Also: Why base the decision on maximum values and not mean values? At the very least, both should be considered - as any eventual risk evaluations will be based off the mean (or 95% UCL on the mean).

7) Page 8, 1st (partial) paragraph - Since you don't have historical methyl mercury data, it might be useful to have a "reference" area. For example, the team could take a soil sample at Site 8 (or maybe an upstream sediment location - with similar grain size and TOC) and analyze it for mercury and methyl mercury? It might be important to establish a "reference level" of methyl mercury in the stream since the screening levels are so low.

Step #1 Compare mercury/lead concentrations in fish tissue

8) Page 8, Scenario A: Is there a decision point for if there is a difference in increase/decrease of mercury by species of fish? For example, what if the concentration of mercury in the fish tissue goes up in bullhead, but down in mosquitofish? Would this default to "A" or would it be "B"? The team might want to consider establishing this ahead of time.

Step #2 Compare mercury/lead concentrations in stream sediment

9) Page 8, 2nd bullet - You might want to reconsider performing a SERA for the sediments. The stream will most likely fail. [As the Hg screening levels are very low (.15 ppm) as are the levels for lead (46.7ppm)]. Perhaps a BERA would be better, although it would be a more in-depth document (although perhaps just through step 3A). It will boil down to the comfort level of our team regarding making risk management decisions.

10) Page 9, 1st bullet on page - The difference in species might also contribute to differing values (see comment #8, above)

Table 1

11) Page 10 - For the mid-section of the stream, the mean is listed as 1.05 ppm, but the range is ND to 0.48ppm. This is probably supposed to be 4.8 ppm, but the numbers should be checked.

Overall comment

12) The DQOs are great...this is a perfect way to quickly set up the decision rules and iron out how the data will be used.

Editorial

13) Page 1, 1st paragraph "Both sites are at located the Naval District..." - switch "at" and "located".

CH2MHILL TELEPHONE CONVERSATION RECORD

Call To:

Jeff Morris/NAVFAC Washington
Shawn Jorgensen/NDWIH
Dennis Orenshaw/EPA
Simeon Hahn/NOAA-BTAG
John Burgess/CH2M HILL
Clair Morris/CH2M HILL
Margaret Kasim/CH2M HILL
Chris English/CH2M HILL

Phone No.:

Date: March 8, 2005

Call From:

Time: 1:00 P.M.

Message Taken By: CH2M HILL

Subject: Sites 8 and 56 Desktop Evaluation (DTE) Technical Memorandum

The objective of the call was to discuss BTAG's comments on the subject document and the path forward for both sites.

Chris English laid out the objective for the meeting and provided an overview of the project – from submittal of the DTE to the receipt of BTAG's comments. The discussion focused on the creek and the pond, biomonitoring reports, and analytical results (before and after the Site 8 and Site 57 removal actions and the biomonitoring studies). Simeon and Dennis pointed out that, before they would agree to no further action for these sites, they wanted to additional sampling conducted in the mid- and lower-sections of the creek and in the pond.

The purpose of the sampling is two-fold: (1) confirm that lead and mercury concentrations in the creek and pond sediment have not increased since the 1996 removal action at Site 56; and (2) confirm that lead and mercury concentrations have not increased significantly in fish tissue samples since the 1995 biomonitoring sampling.

As a result of the discussions that ensued, the following actions were agreed to by all parties:

1. Hold off closing out Sites 8 and 56 until the proposed sampling, outlined below, has been completed.

2. Prepare a letter work plan, with some DQO details (not full-blown), presenting the sampling approach.

3. Collect sediment samples along the middle and lower sections of the stream, defined in the DE as extending from the downstream edge of the 1994 Site 8 Removal Action to the tidal pond (see Figure 2 in the June 2004 DTE for the locations of these stream sections). Samples will be analyzed only for lead and mercury. Simeon mentioned that 3 or 4 samples along each section should be sufficient.

4. Collect sediment and fish tissue samples from the pond. Sediment samples will be analyzed for lead and mercury. Fish tissue samples will be analyzed for lead, mercury, and methyl mercury. Again, the number of sediment samples will be about on the order

of 2 or 3. The number of fish samples will ensure coverage for assessment of the spatial distribution of lead and mercury in the pond. Sampling the pond will serve as a biomonitoring approach for risk assessment.

5. The findings will be documented in a technical memorandum and presented to the partnering team for the team to use in making a risk management decision.

Simeon and Dennis indicated that, if the results are comparable to those from previous sampling events, then this would suggest that there is no further impact from the sites and that they would agree to no further action for these sites. However, if the results are significantly higher than previous sampling results, then the team will have to make a decision as to the path forward for these sites.

Though it was not presented to all parties, it is CH2M HILL's intent to conduct the sampling in conjunction with the Sites 19, 26, 27, SWMU 14, SWMU 30, and Abandoned Drums Wetland Area fieldwork.

Morris, Jeffrey CIV (NAVFACWASH)

From: Morris, Jeffrey CIV (NAVFACWASH)

Sent: Thursday, May 25, 2006 11:25 AM

To: DeTore Curtis (E-mail); Ed Corack; Jorgensen, Shawn; Kasim Margaret (E-mail); Latulippe George (E-mail); Morris, Jeffrey CIV (NAVFACWASH); Orenshaw Dennis (E-mail); Rail, Joseph CIV (NAVFACWASH)

Subject: Additional Investigation Results for Sites 8 & 56 - Comments

I have only these minor comments:

1. On page 1 under Section 2.0, the draft Desk-top Evaluation is used as a reference. I am concerned that this could force us to retain the draft document in the Administrative Record. Since you can hardly reference a final version that 1) does not exist yet and 2) couldn't be cited in a document used to develop it, it may be necessary to either reference another document for the information or supply that information in this tech memo.

2. On page 15, the first recommendation is for further investigation involving possible risks to the benthic community and amphibians. What do you have in mind?

Jeff Morris
Remedial Project Manager
Naval Facilities Engineering Command Washington
1314 Harwood St SE
Washington Navy Yard DC 20374-5018
202-685-3279
DSN 325-3279

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CH2MHILL

May 18, 2006

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06-CEE-0229

Mr. Jeff Morris, Code C21CE
Naval Facilities Engineering Command, Washington
1314 Harwood St., SE
Washington Navy Yard, Bldg. 212
Washington DC 20374-5018

Subject: Navy CLEAN II Program
Contract N62470-02-D-3052
Contract Task Order 0050
Technical Memorandum for Additional Investigation Results for Sites 8 and 56
Naval Support Facility, Indian Head (NSF-IH), Indian Head, Maryland

Dear Jeff:

CH2M HILL is pleased to submit two hard copies and one pdf CD of the above-referenced document for your review. Please provide comments to CH2M HILL by July 14, 2006. Copies of the document have also been distributed as shown below.

If you have any questions regarding this deliverable, please do not hesitate to contact me at (314) 421-0313 ext. 221.

Sincerely,

CH2M HILL

Christopher E. English

Christopher E. English, P.E.
Project Manager

STL\LETTER 051706 Sites 8 & 56 TM.doc

c: Shawn Jorgensen/NSF-IH (2 hard copies, 2 CDs)
Curtis DeTore/MDE (1 hard copy)
Dennis Orenshaw/USEPA (2 hard copies, 1 CD)
Simeon Hahn/NOAA (1 hard copy)
Devin Ray/USFWS (1 hard copy)
CH2M HILL (4 hard copies)
Noelle Cuti/File/CH2M HILL (cover letter only)

Enclosures